

NET ZERO TEST

Analysis of how far Autumn Budget and
Comprehensive Spending Review 2021
aligns with UK net zero target



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YOUR
WORLD

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Report prepared with analytical support from Vivid Economics

1. EXECUTIVE SUMMARY

NET-ZERO TEST

The impacts of the climate emergency are becoming clearer by the day and nature - a vital ally against climate breakdown - is in freefall. Urgent action is needed to limit global warming to 1.5°C and the UK must play a leading role. Climate policy and economic policy can no longer be viewed in isolation from one another – the net zero transition will cause profound economic and social change. To ensure that the UK seizes the opportunities of the transition and prosperity is distributed across the country, the UK Government needs to better understand the environmental impacts of its spending.

WWF-UK IS CALLING ON THE UK GOVERNMENT TO APPLY A NET ZERO TEST (NZZT) TO ALL SPENDING AND TAXATION DECISIONS IN BUDGETS AND SPENDING REVIEWS

In this context, WWF-UK is calling on the UK Government to apply a Net Zero Test (NZZT) to all spending and taxation decisions in Budgets and Spending Reviews to ensure that the overall package puts us on track to meet our climate and nature goals. WWF-UK has developed a world-leading Net Zero Test, with the support of Vivid Economics, and applied it to the Autumn Budget and Comprehensive Spending Review (CSR). While the results suggest that this Budget and CSR will drive down emissions in the long term, the policies outlined are still not sufficient to deliver the low-carbon transition required to align with the UK Government's legally binding net zero commitment.

A range of organisations across the economy have expressed support for the Net Zero Test, including CBI, the TUC, the Corporate Leaders Group, Energy-UK, National Grid, and the Climate Change Committee, and the tools to deliver this are now available.

WHAT IS THE PROBLEM?

While the net zero target is part of UK law, and the UK Government has a way of assessing the emissions impact of individual policies, it is currently difficult to ascertain total spending on green policies versus polluting ones. At present, there is also no way of assessing if the overall choices made in Budgets and Spending Reviews are getting us on track for net zero emissions or taking us in the opposite direction. HM Treasury referenced this problem in the recent Net Zero Review, stating that “there is no internationally adopted methodology for assessing and reporting on the climate change impacts of government spending in aggregate.... Nor (for) taxation”.¹

Given that government expenditure represents around 45% of UK national income², it is essential that it is being invested in policies that protect the planet and turbocharge a green economy, not on polluting assets and schemes that cause dangerous climate change and damage people's health.

WHAT IS WWF-UK DOING TO SOLVE THIS?

WWF-UK has created a Net Zero Test, which is comprised of two elements:

- A budget tagging tool, which provides an assessment of the alignment of spending and taxation policies in Budgets or Spending Reviews with a range of climate and other environmental criteria, showing how much is being spent on green policies versus polluting ones.
- An emissions estimate tool, which estimates the impact of policy decisions outlined in Budgets and Spending Reviews on greenhouse gas emissions, in order to assess the overall impact of fiscal events on progress towards net zero.

The NZT aims to sit alongside and strengthen existing processes for aligning fiscal policy with environmental goals. The Test can incorporate calculations of environmental impacts derived from Green Book assessments and departmental spending proposals submitted into a CSR, as well as estimating emissions where these calculations have not been undertaken. The Test would help HM Treasury comply with the recommendations of the Climate Change Committee to introduce a Net Zero Test³ and of the Public Accounts Committee and National Audit Office to assess the aggregate climate impacts of policies at fiscal events.⁴ Finally, adoption of the NZT would enable the UK to build on its decision to join the OECD Paris Collaborative on Green Budgeting and demonstrate international leadership in this space.

BENEFITS OF ALIGNING SPENDING AND TAXATION WITH NET ZERO

Introducing a Net Zero Test will help government to target investment towards green infrastructure, which could unleash a wave of green private sector spending and unlock £90 billion of annual benefits, including green jobs and export opportunities, warmer homes, and more green space for everyone. Investment in low-carbon infrastructure can boost long-term productivity and has high returns, as every pound spent on low-carbon investment options returns 3-8 times the initial investment.⁵

Investing in net zero is good for communities and can help to deliver the UK Government's levelling up agenda by creating thousands of high-quality green jobs, many in areas that are experiencing high unemployment after the pandemic. As well as being in predominantly low-wage areas, these jobs are better paid than the national average and those in carbon-intensive industries. Many can be created quickly – for example, delivering a net zero building stock would create 350,000 additional jobs in the construction sector by 2028⁶, while investing in public transport, such as electric rail and bus services, could create 230,000 jobs.⁷

The NZT will help government manage the net zero transition to ensure that UK citizens benefit, including health benefits and savings to the NHS from more active travel, reduced air pollution and more access to green space, and financial savings, through reduced energy bills and fuel costs, as well as higher value pensions. It will also enable increased access to green space and thriving wildlife, through expanded and better maintained forests and grasslands and cleaner seas.

SPENDING ON CLIMATE POSITIVE POLICIES INCREASED BUT THE UK GOVERNMENT STILL HAS A LOT OF WORK TO DO - THE AUTUMN BUDGET AND CSR DOES NOT DO ENOUGH TO GET THE UK ON TRACK FOR THE NET ZERO PATHWAY

Investing now can position the UK as a leader in the global markets of the future and build resilience into public finances. Green exports could grow from £5billion to £80billion per annum by 2050, supporting 200,000 export-orientated jobs and a further 270,000 jobs in domestic low-carbon opportunities⁸. Delivering net zero could unlock over £130 billion in annual benefits for the UK, including over £50 billion in business opportunities and £80 billion in co-benefits, including improved health due to cleaner air and warmer homes, as well as improved access to green space.

Acting early will also safeguard the UK from major costs further down the line - delaying for ten years would double the amount of investment to hit the same target⁹, and would risk causing a major recession¹⁰. The UK's Net Zero Pathway will generate enough carbon tax revenues to cover the public costs of the transition twice over, and will reduce public debt, making early action the fiscally responsible course of action.¹¹

RESULTS FROM APPLYING THE TEST TO THE AUTUMN 2021 BUDGET AND COMPREHENSIVE SPENDING REVIEW

WWF-UK applied the Net Zero Test to the Autumn 2021 Budget and Comprehensive Spending Review (CSR). The results present a mixed picture, with investment in energy, transport and Research and Development (R&D) set to deliver emissions reductions and Business Rates support for green technologies and property improvements likely to have a positive impact on climate change mitigation. These reductions, however, are partially undermined by high-carbon policies such as freezing fuel duty, increased investment in new roads and reducing air passenger duty for domestic flights which drive up emissions over the next three years.

The UK Government still has a lot of work to do, as the Autumn Budget and CSR does not do enough to get the UK on track for the Climate Change Committee's (CCC) Balanced Net Zero Pathway. This is for several reasons:

- The Budget includes £55 billion, over four years, of spending on policies that actively work against our climate goals and drive up emissions.
- The majority of positive spend focuses on R&D which, while welcome, has uncertain benefits and does not deliver the near-term emissions reductions of more 'shovel-ready' projects, such as, for example, a properly funded energy efficiency retrofit programme. It is vital that Government take action now to avoid the worst impacts of climate change; as mentioned above, delaying investment for ten years would double the amount needed and create an unnecessary financial burden for future generations.
- The vast majority of spending is still 'neutral', rather than actively supporting the green transition, and there are a number of missed opportunities to green day-to-day government spending, such as ensuring that skills and retraining funding focuses on promoting the skills needed to support the UK's fast-growing green industries.
- There is a clear policy and regulatory gap – further regulation and incentives are needed to stimulate private investment to help deliver the required emissions reductions to meet the Net Zero Pathway.

In addition, future Budgets and Spending Reviews are likely to deliver short-term emissions increases through departmental spend, as well as potentially some carbon-abating policy measures, meaning that the predicted medium-term emissions reductions from this Budget's investments may be undermined.

The Autumn Budget and Comprehensive Spending Review contained spending on climate positive policies, totalling £29 billion per year over four years, as would be expected when deciding departmental spend and following the publication of the Net Zero Strategy ahead of COP26. Most of this spending, however, was on policies whose emissions reduction impacts are relatively uncertain or mixed and do not deliver concrete emissions reductions in the short-term. If these policies deliver, the decisions are estimated to yield a net emissions reduction of 745 MtCO₂e over the extended 25-year assessment period.¹¹

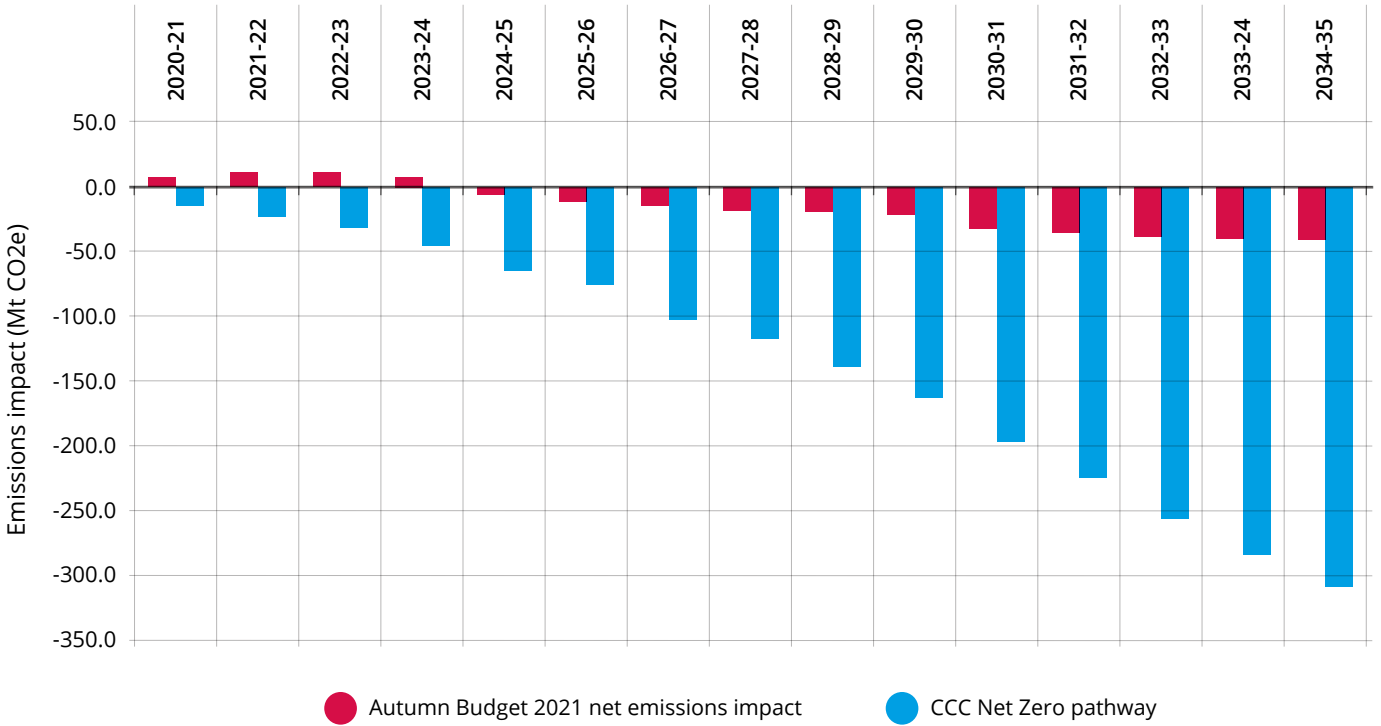
While this represents a significant reduction, the Budget and Spending Review is forecast to deliver less than 12% of the overall emissions reduction required over that 25-year period to align with the Net Zero Pathway. Public spending will only represent around 25% of the investment needed to deliver net zero, but it is essential that spending is well-targeted and sufficient to deliver the emissions reductions needed. Government also needs to provide stronger regulation and incentives to encourage the private sector to deliver the remaining 75% of investment needed to hit net zero. While the Net Zero Strategy set a direction of travel for each sector, a number of areas lacked sufficiently detailed policies to deliver the transition.

In order to ensure the UK gets and stays on track for net zero, and to unlock the benefits of the transition, outlined above, the UK Government should apply the Net Zero Test to all future fiscal events. This would allow it to understand which policies are driving emissions increases and reduce or compensate for their impact, while introducing green conditionality for departmental spend, requiring departments to consider climate mitigation actions when implementing their spending. For example, the UK Government could have attached green conditionality to funding for skills training, apprenticeships and retraining opportunities for adults, thereby promoting the growth of skills that are essential to the net zero transition and will enable access to good jobs in the UK's fast-growing green industries.

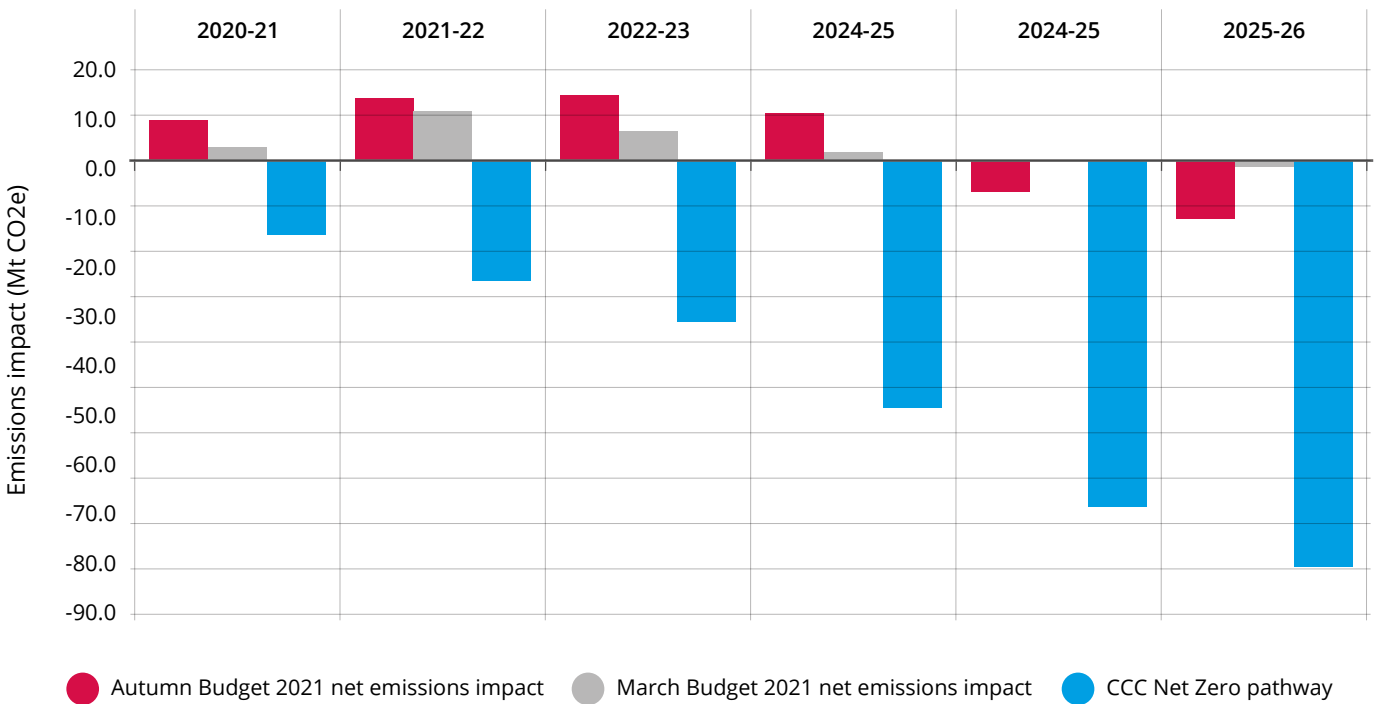
It is essential that any Net Zero Test analysis is published and examined by the Climate Change Committee and Office for Budget Responsibility. This will help to highlight policies that have a higher delivery risk associated with them, such as Carbon Capture Usage and Storage and large-scale nuclear, as well as providing scrutiny where UK Government environmental impact estimates differ greatly from external estimates, such as in relation to the Road Investment Strategy 2020-25.

While the results of the Net Zero Test suggest that the Autumn Budget and CSR is considerably more climate positive than the March 2021 Budget, the policies outlined are still not sufficient to deliver the low-carbon transition required to align with the UK Government's legally binding net zero commitment. By adopting a Net Zero Test and applying it to all future fiscal events, the UK Government can track progress and ensure the UK hits its net zero target.

COMPARISON OF AUTUMN 2021 BUDGET AND CSR AGAINST CCC NET ZERO PATHWAY



COMPARISON OF MARCH 2021 BUDGET AND AUTUMN 2021 BUDGET AND CSR AGAINST CCC NET ZERO PATHWAY



WHAT SHOULD THE UK GOVERNMENT DO NOW?

If they are to deliver on their climate promises, the UK Government must make sure public money is spent on building towards the greener, cleaner future that we all want. This should be done by introducing a Net Zero Test, requiring the Treasury to measure all future spending plans against the UK's climate and environment commitments.

This would mean that, at each Budget or Spending Review:

- Budget tagging is used to undertake a systematic analysis of the alignment of all spending and taxation policies with a range of climate and other environmental criteria.
- Quantitative analysis of carbon emissions is also required for all spending and taxation policies taken within a Budget or Spending Review.
- HMT publishes the results of the above analyses, together with an assessment of whether the overall emissions impact is compliant with a net zero trajectory, and a summary of how the analysis was used to inform the spending/taxation decisions made in the Budget or Spending Review.
- The OBR is responsible, guided by the CCC's professional advice and assessment on carbon budgets, for assessing government delivery against the Net Zero Test, reporting the results to Parliament.



NEXT STEPS FOR IMPLEMENTING THE NET ZERO TEST

To implement the NZT, the Treasury should develop a strategic plan to ensure that:

- Net zero is mainstreamed into fiscal policy by the Treasury committing to **apply a full Net Zero Test**, involving both budget tagging and emissions estimates, **to all future fiscal events**.
- **Departments are supported to adopt the NZT in their own processes for Budget preparation.** The Treasury can support capacity-building among Departments to use the NZT in departmental budgetary processes.
- **The UK engages closely with the OECD Paris Collaborative on Green Budgeting.** This will help to build capacity for integrating climate and environmental objectives into fiscal policy.
- **The quality of inputs to the NZT is iteratively improved.** The ability of the NZT to deliver robust results depends on the information on each Budget line that is entered into it. In particular, the Treasury could:
 - **Encourage a disaggregated expenditure breakdown of large projects**, to isolate the spending which is ‘environmentally relevant’.
 - **Align the NZT with existing approaches for estimating emissions**, to ensure that emissions estimates from Green Book assessments or Spending Review submissions for capital expenditure can be integrated within the NZT. This may include compiling these emissions assessments centrally.
 - **Support capacity-building among departments** to assess emissions accurately and consistently, for example through strengthening guidance and developing clear templates.
- **NZT methodologies are regularly reviewed and refined.** Methodologies for assessing emissions should be regularly reviewed, for example by comparing ex ante estimates of emissions with ex post evaluations. The Treasury could also consider developing a broader set of policy archetypes for the NZT, including archetypes which are more relevant to CSRs, such as large-scale infrastructure projects.
- **Scrutiny of NZT results is facilitated.** In adopting the NZT, the Treasury should ensure there are clear processes for review and validation, for example through engagement with the OBR, to ensure the robustness of the analysis. The Treasury should also consider publishing the results of the NZT to support greater transparency, accountability, and public engagement on how the government is using fiscal policy to delivery net zero and other environmental goals.
- **The NZT is used at key stages of decision-making.** Using the NZT for awareness-raising is likely to have limited impact on aligning fiscal policy with net zero. Instead, the Treasury should utilise the NZT across key stages in the Budget cycle (planning, approval, implementation, and audit).
- **The NZT is extended to encompass to other environmental objectives.** Strong and healthy ecosystems help fight climate change as well as building resilience. The first step in extending the NZT to include other environmental objectives would require developing a clear set of nature-relevant metrics which could be assessed in the policy appraisal process.

2. INTRODUCTION

This report summarises the results from applying the Net Zero Test to the UK government’s spending plans announced in the Autumn 2021 Budget and Comprehensive Spending Review.

The UK’s ambitious climate targets will require decisive and coordinated government action. In 2019 the UK became the first major economy to legislate for Net Zero emissions by 2050. Delivering this target will enable the UK to maintain its climate leadership, create new economic opportunities and deliver critical benefits for the natural environment and people’s wellbeing. However, Net Zero will not happen without concerted focus from government. The Climate Change Committee has estimated that achieving Net Zero will require increasing low carbon investment to £50 billion annually by 2030. Although direct public sector investment will constitute a relatively small proportion of this, government policy plays a critical role in directing private sector investment and supporting households to engage with the transition.

WWF-UK has developed a Net Zero Test to support ambitious fiscal policy. Fiscal policy is the use of government spending and taxation to influence the economy. The UK’s fiscal events – annual Budgets and multi-year Comprehensive Spending Reviews (CSR) – determine the allocation of fiscal resources for achieving national goals and reflect the relative priorities across government. The UK’s ambitious climate agenda requires Net Zero to be built into the processes of allocating budgets to departments, prioritising policies and ensuring a coordinated policy approach. The Net Zero Test (NZT) provides the Treasury with a tool to support the mainstreaming of Net Zero into fiscal policy. It has two components: (1) assessing whether financial flows in a fiscal event are consistent with Net Zero and (2) quantifying the aggregate impact of fiscal events on emissions.

Budgets and Comprehensive Spending Reviews are key policy documents that need to be supporting the UK’s Net Zero ambition. Figure 1 below explains how the Net Zero Test has been designed to encourage greater integration of net zero principles into UK fiscal policy.

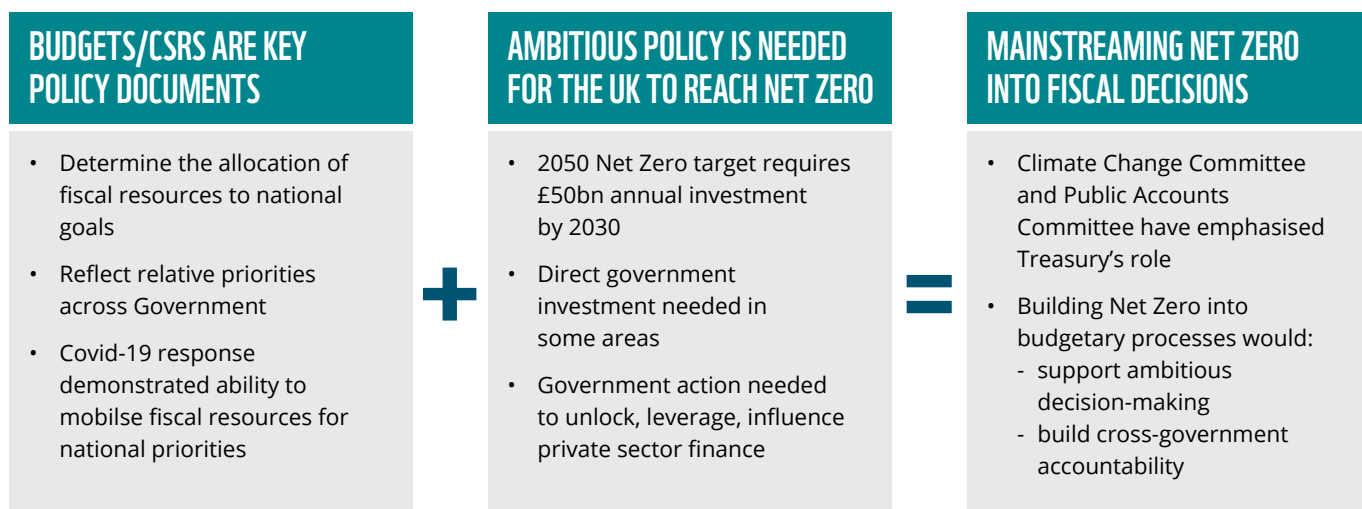


Figure 1
Usefulness of Net Zero Test to UK fiscal policy and Net Zero

The NZT aims to sit alongside and strengthen existing institutional practices for monitoring the emissions impact of fiscal policy. These existing efforts take three forms:

- **The Climate Change Committee (CCC) is an independent, statutory body which reports on progress made in reducing greenhouse gas emissions and climate change adaptation.** It sets out carbon budgets and monitors progress in achieving these. The NZT can assess whether government fiscal policy is consistent with CCC targets.
- **Since 2020, departmental submissions to Treasury ahead of the Comprehensive Spending Review are required to include a detailed assessment of the climate impacts of their capital expenditure.** The UK Department for Business, Energy and Industrial Strategy (BEIS) has supported Treasury in developing guidance for these submissions and scrutinising departmental bids. These climate assessments have not been published, with the Public Accounts Committee noting that not all departments complied with these requirements and that departments applied inconsistent methodological approaches.¹² Where detailed climate impact assessments exist, the NZT can incorporate these into its assessment of the aggregate impact of fiscal events on emissions.
- **All policy, programme and project proposals are required to undertake a Green Book assessment as part of the appraisal process.** Where the project is assessed to have a tangible impact on emissions, the Green Book assessment requires the impact on emissions to be quantified and monetised. BEIS has recently set out a revised approach to valuing greenhouse gas emissions in policy appraisal.¹³ Although the guidance outlines that these assessments should be carried out on policies which have both a direct and indirect impact on emissions, presently emissions assessments are only carried out for a narrow subset of policies. The NZT supplements this by providing an approach to estimating emissions for all policies, so the Treasury can understand the aggregate emissions impact of fiscal events.

The NZT has been designed to support the UK government in its commitment to aligning fiscal policy with Net Zero. In June 2021 the UK government committed to joining the OECD Paris Collaborative on green budgeting, a cross-governmental initiative to support the incorporation of climate and environmental considerations into fiscal policymaking. By supplementing existing institutional structures, the NZT will support the Treasury in leveraging its unique oversight role to ensure the delivery of Net Zero. In particular, the NZT could be used by Treasury to flag policies which are expected to have a large negative impact on emissions. This could facilitate discussions with departments about whether the policy is in line with government strategic objectives, whether the policy could be altered to reduce the impact on emissions, or whether there might be scope for ambitious policy elsewhere to counteract these impacts. Given the Treasury's role in ensuring that the allocation of fiscal resources reflects national goals, the NZT can also support Treasury to prioritise policies and monitor the alignment of fiscal policy with Net Zero delivery. The NZT can also be used by civil society to advocate for greater ambition and transparency in meeting Net Zero.



3. METHODOLOGY

The objective of the NZT is to assess the alignment of fiscal policy with the UK's Net Zero ambition. It achieves this through two components:

- a **Budget Tagging Tool** provides a qualitative assessment of the alignment of financial flows announced in Budgets or Comprehensive Spending Reviews with the Net Zero target.
- an **Emissions Estimate Tool** estimates the impact of individual policy decisions outlined in Budgets and Comprehensive Spending Reviews on emissions to estimate the aggregate impact of fiscal events on progress towards Net Zero.

Table 1 compares the objectives and outputs of the two Tools, with the section below providing a high-level description of the methodology.

Tool	Objective	Approach	Environmental dimension	Outputs
Budget Tagging Tool	Assess whether the allocation of fiscal resources outlined in a fiscal event is aligned with the Net Zero objective.	Qualitative scoring	Mitigation, adaptation, biodiversity, water management, air pollution, circular economy.	<p>Absolute value of environmental positive and negative spending and taxation decisions.</p> <p>Value of mitigation positive and negative spending decisions, expressed as a proportion of estimated requirements.</p> <p>Spotlight on positive/negative environmental policies.</p> <p>Score for fiscal event, to allow comparison over time or across environmental dimensions.</p>
Emissions Estimate Tool	Estimate the total impact of emissions resulting from a fiscal event.	Quantitative	Mitigation	<p>Emissions impact of fiscal event, disaggregated by year and department.</p> <p>Comparison of emissions impact to CCC Net Zero Pathway.</p> <p>Spotlight on positive/negative environmental policies.</p>

Table 1
Comparison of the Budget Tagging Tool and the Emissions Estimate Tool

A. BUDGET TAGGING TOOL

Climate Budget Tagging Tools are well-established methods for tracking climate-relevant expenditure and taxation decisions, informing decision-making and building accountability. Since 1998, the OECD Development Assistance Committee has monitored development finance flows targeting the objectives of the Rio Conventions on biodiversity, climate change and desertification by requiring members to indicate for each development finance activity whether it targets environmental objectives. In 2021, the French Government adopted green budget tagging as part of its green budget programme, with the aim of improving transparency around environmental policymaking. The Budget Tagging component of the NZT has drawn on these international experiences, as well as established best practice guidelines.^{14,15,16}

The Budget Tagging Tool qualitatively scores each spending and taxation decision announced in fiscal events against six environmental dimensions. The six environmental dimensions are taken from the European Union’s Sustainable Finance Taxonomy which covers: (1) climate change mitigation; (2) climate change adaptation; (3) biodiversity; (4) water management; (5) air pollution and (6) circular economy. Each policy decision is scored according to a qualitative assessment of its environmental impact, as Figure 2 outlines. The annex of this report contains ‘a decision tree’ to explain how one can score an individual policy along this qualitative scale.

The outputs of the Budget Tagging Tool include the value of the positive and negative environmental decisions and a score for each environmental dimension. For the mitigation dimension, the assessment compares the value of mitigation-positive spending decisions with external estimates of the investment required for the UK to reach Net Zero. The Budget Tagging Tool also provides a score for each environmental dimension which ranges from +100 to -100 (where a score of +100 would indicate that all commitments made in the fiscal event support strong positive progress towards environmental outcomes), allowing for comparison over time or across dimensions. The tool also spotlights the key positive and negative decisions, based on the value of the policies.

N2	N1	Z	P1	P2
Strong negative progress towards environmental outcomes	Negative progress towards environmental outcomes	Neutral effect on environmental outcome- not relevant for mitigation	Positive progress towards environmental outcomes	Strong positive progress towards environmental outcomes
-5	-2.5	0	2.5	5

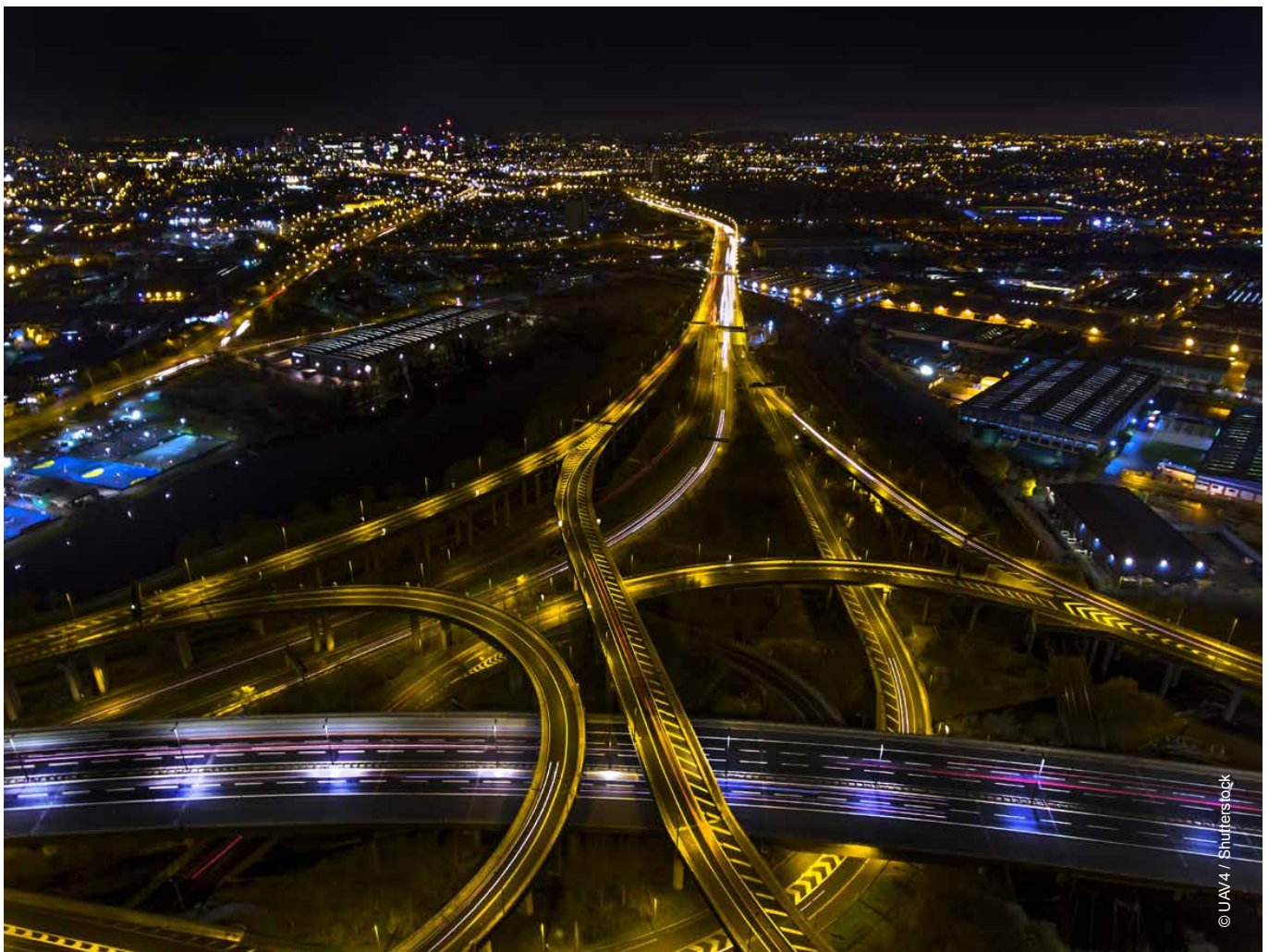
Figure 2
Conceptual framework to estimate indicative emissions impact

BOX 1

LIMITATIONS OF THE BUDGET TAGGING TOOL

The Budget Tagging Tool faces the following limitations:

- **Qualitative** – the qualitative scoring means that the tool relies on subjective assessment, although the scoring is determined by a clear rubric to ensure transparency and replicability.
- **Determined by financial flows** – the output metrics are driven by the financial size of the spending or taxation decision, which will not always reflect the environmental impact.
- **Ambition** – the Tool compares the value of environmentally positive or negative decisions to external assessments, but cannot fully determine whether fiscal policy is sufficiently ambitious. This is for two reasons: (1) it is a political decision over how the financial burden of achieving net zero should be distributed across government, business and households – although there have been estimates of total investment need, there is no fixed estimate of how much government expenditure is required; (2) the absolute value of spending and taxation decisions may be a poor indicator of the impact on achieving net zero – it is important that fiscal policy is well-targeted to achieve impact.



B. EMISSIONS ESTIMATE TOOL

The Emissions Estimate Tool provides a quantitative estimate of the total impact of a fiscal event on greenhouse gas emissions. At present, departments are required to assess the impact on emissions in two circumstances: (1) in Comprehensive Spending Review departmental bids, where they are required to assess the emissions impact of capital expenditure programmes; or (2) as part of Green Book value-for-money appraisals, where a policy is assessed to have a direct or indirect impact on emissions. The Emissions Estimate Tool supplements these existing arrangements by providing an emissions assessment of all policies and aggregating them in order to provide an overall assessment of the impact of fiscal events on emissions.

i. Approach to emissions estimates

The Emissions Estimate Tool estimates the emissions impact of all policy decisions announced in fiscal events through a two-step process. Figure 3 summarises the conceptual approach, which is designed to be replicable and transparent. In the first step, the Tool estimates the economic impact of the policy based on economic multipliers established in the literature. These multipliers vary by policy type, with five policy archetypes: *(examples given after hyphen)*

- **Transfers to and from households** – social security policies and income taxes
- **Transfers to and from businesses** – corporation taxes
- **Public services** – education or investment in public capacity
- **Public programmes** – programmes to support private sector activity
- **Indirect taxes** – taxes which change the prices of goods, such as fuel duty

In the second step, sector-specific or economy-wide emissions factors translate the economic impact into an estimate of the impact on emissions.



Figure 3
Conceptual framework to estimate indicative emissions impact

The two-stage approach applied above is only appropriate where the policy does not change the emissions intensity of the relevant sector or economy. Where the policy is expected to increase or decrease the emissions intensity, bespoke modelling is required. In these cases, emissions estimates conducted as part of Green Book assessments can be inputted into the Tool to provide a robust estimate of emissions impacts.

The estimated emissions impacts are summed together to estimate the total impact of a fiscal event on emissions. The Tool is able to disaggregate the impact by year and by Department responsible for the policy. The emissions impact of the fiscal event is compared in the Tool to the CCC’s carbon budget for its Balanced Pathway to Net Zero. The Tool also spotlights the policies which are the biggest contributors to emissions increases and the policies which most support emissions reductions.

ii. Methodological improvements for Autumn 2021 Budget and CSR

The Autumn 2021 Comprehensive Spending Review introduced long term infrastructure policies that have required the development of new estimation techniques. These policies will aim to reduce the emissions intensity across the economy over the longer term. As a result, this iteration of the Tool includes three new policy archetypes: energy infrastructure, R&D spending, and transport infrastructure. The announced changes to air passenger duty also required small amendments to the indirect tax estimation technique. The new policy types estimated in the Autumn 2021 Budget and CSR are shown in Figure 4.





 INDIRECT TAXES	 ENERGY INFRASTRUCTURE	 R&D SPENDING	 TRANSPORT INFRASTRUCTURE
POLICY DESCRIPTION			
1. Domestic air passenger duty (APD) 2. Ultra long-haul (APD)	3. Carbon capture usage and storage (CCUS) 4. Offshore wind 5. Hydrogen 6. Nuclear 7. Energy efficiency	8. General R&D spend 9. Green conditional R&D spend	10. Railway 11. Buses 12. Active transport 13. Road network 14. Electric vehicle charging infrastructure
ESTIMATION APPROACH			
Uses same process as other indirect taxes, using income effect and price elasticities	Estimate generation capacity from planned investments, assume this displaces generation from gas powered stations	Estimate the effect of R&D spend on economy-wide emissions based on parameters from the literature on how R&D affects the UK emissions intensity	Estimate change in passenger kms between different modes of transport based on policy intervention, calculating through emissions/kms of different modes

Figure 4
 Estimation approaches introduced in Autumn 2021 Budget and CSR
Note: No specific literature was identified for the specific effects of ‘green’ R&D, so the emissions estimates for ‘green conditional’ R&D use the same method as for other R&D spending that may not have an explicit environmental focus.

Table 2 summarises the common characteristics between the emissions estimates approaches for these new policies. The table shows the methodological changes introduced as a result of the different characteristics of the new policies.

Additionality	In joint public-private funded projects the Tool attributes 100% of the change in emissions to government: meaning that public money is an essential enabler of private investment, and zero investment would go ahead without public money moving first. Where crowding in of private sector money is expected (e.g. EV charging infrastructure) the Tool assumes that government funding fulfills 25% of the total funding.
Construction effects	The Tool separately estimates construction and operational emissions from transport and energy infrastructure projects. The Tool calculates the construction emissions using the standard emissions intensity of output in the construction sector. Operational emissions estimates are bespoke based on the infrastructure type.
Preference for project-specific modelling	Where government has already modelled the expected emissions reductions from a particular investment (e.g. hydrogen generation capacity), this project-specific modelling is preferred to the Tool's estimated impacts.
25-year time horizon for infrastructure projects	The emissions estimates for tax and other short-term spending items run only for 4 years, the funding period which the budget announcements will cover. The Tool now has an extended emissions estimate period of 25 years for infrastructure projects, as most will take 3-5 years to complete, with emissions savings accruing after the construction. The costs of these longer-term projects are still only considered for the 4-year period covered by the spending review.
Set method for non-environmentally-relevant infrastructure	For non-environmentally-relevant construction projects (e.g. school and hospital building) the Tool estimates the emissions using the standard carbon intensity of the construction sector.

Table 2
Methodological updates for Autumn 2021 Budget and CSR

BOX 2

LIMITATIONS OF THE EMISSIONS ESTIMATE TOOL

The Emissions Estimate Tool faces the following limitations:

- **Policy interactions** – policies can be complementary, overlapping or countervailing in their climate impacts.¹⁷ The Tool assumes the emissions impacts are additive, which means these interactions are not accounted for. This is an area that could be addressed in future iterations of the Tool.
- **Integration of existing emissions estimates** – although the Tool has been designed so that emissions assessments conducted by departments as part of Green Book assessments or capital spending bids can be inputted, this information is not publicly available which has meant that the functionality could not be tested. The Treasury could provide feedback on this.
- **Technology-specific emissions factors** – at present, the Tool only includes sector-wide emissions factors, with all policies which change the emissions intensity of the sector requiring bespoke modelling. As the Tool is used over multiple fiscal events, this will create a database of environmentally relevant policies which can be used to develop a broader set of emissions factors.
- **Ambition** – the Tool provides an assessment of the aggregate impact of fiscal events on emissions and compares this to the Climate Change Committee's Net Zero Pathway. However, the Tool cannot fully assess whether fiscal policy is sufficiently ambitious. This is because meeting Net Zero will require other forms of government policy to direct private sector action, such as regulatory, monetary and macro-prudential policy. The Tool also only focuses on the impact of new policy decisions, rather than estimating the total impact of government spending and taxation.

4. APPLICATION OF THE NET ZERO TEST TO AUTUMN 2021 BUDGET AND CSR

The NZT was applied to the Autumn 2021 Budget and CSR to demonstrate its ability to assess the alignment of all new spending and taxation decisions with the Net Zero target. The 2021 Budget was exceptional in two main ways: it was the second Budget of the year (following one in March 2021), and this Budget included a Comprehensive Spending Review (CSR) that sets departmental spending expectations for the next three years. The main theme of the Budget was ‘Build Back Better.’ It provided funding assurance for several previously announced plans and policies including the Net Zero Strategy, National Infrastructure Strategy, Roads Investment Strategy, and the UK R&D Roadmap. Figure 5 summarises the key themes from the Chancellor’s budget announcement on 27 October 2021.








						
Strong and innovative public services	Investing in growth	Supporting people and businesses	Building back greener	Levelling up	Advancing Global Britain	Seizing the opportunities of Brexit
Public services recovery Public services fit for the future (health, education, housing, criminal justice, local government)	Unleashing innovation Delivering an infrastructure revolution Boosting skills	Reforming taxes (business rates, R&D reliefs) Encouraging investment Supporting hard hit sectors (creative, airports, HGVs) Raising living standards (jobs, living wage, skills, universal credit, fuel duty) Support for veterans	Greener transport (R&D, ICE phase out, active and public transport) Warmer, greener buildings (heat pumps, business rates relief) Decarbonising energy and industry (hydrogen, carbon capture, nuclear, wind) Natural environment	Spreading opportunity and improving public services (skills, youth, health, housing) Boosting living standards (productivity, business investment, infrastructure) Restoring local pride	Development and diplomacy Tackling global challenges Defence and security	Reforming the tax system (shipping, alcohol, air passenger duty) Freeports Trade services and customs

Figure 5
Key Themes from Autumn 2021 Budget and Comprehensive Spending Review
Note: R&D: Research and Development; ICE- Internal Combustion Engine

The results from the NZT are outlined in the sections below.

A. BUDGET TAGGING

i. Autumn 2021 Budget and CSR Budget Tagging Results

Table 3 summarises the fiscal scoring in the Budget. Of the 283 decisions announced in the Budget, with a total absolute value of roughly £2.6 trillion, 216 policies, with an absolute value of roughly £2.5 trillion, are neutral with regard to mitigation. This is consistent with the finding of the March 2021 Budget that most spending decisions from government are not explicitly focused on specifically 'net zero' projects.

	Policy tag	Total	Spend	Tax
Number of relevant fiscal decisions	P2	23	20	3
	P1	20	18	2
	Z	216	188	28
	N1	16	14	2
	N2	8	2	6
Absolute value of relevant fiscal decisions (£ billion)	P2	22	22	0
	P1	94	93	2
	Z	2489	2322	167
	N1	23	23	0
	N2	32	25	8

Table 3
Autumn 2021 Budget and CSR Budget Tagging results – mitigation decisions

The most significant policy announcements driving these results are included in Figure 6 below. High Speed Two (HS2) is classified as positive for mitigation due to the effect of the modal shift it will induce, decreasing the number of journeys by car and air. Investment in roads has been classified as having a negative impact on emissions as the increased road use will generate additional emissions even when accounting for expected increases in use of electric vehicles. Note that these results are sorted by fiscal value of the tax or spending decision, not the expected impact on overall emissions. This comes in the following section on emissions estimates results.

TOP POSITIVE POLICIES FOR MITIGATION

Policy	Assessment	Value (£ bn)
Increasing public investment in R&D	P1	33
High Speed Two, rail enhancements and renewals to improve passenger journeys and connectivity	P1	10
Keep essential rail services running and deliver reforms to become a modern and efficient service	P1	5

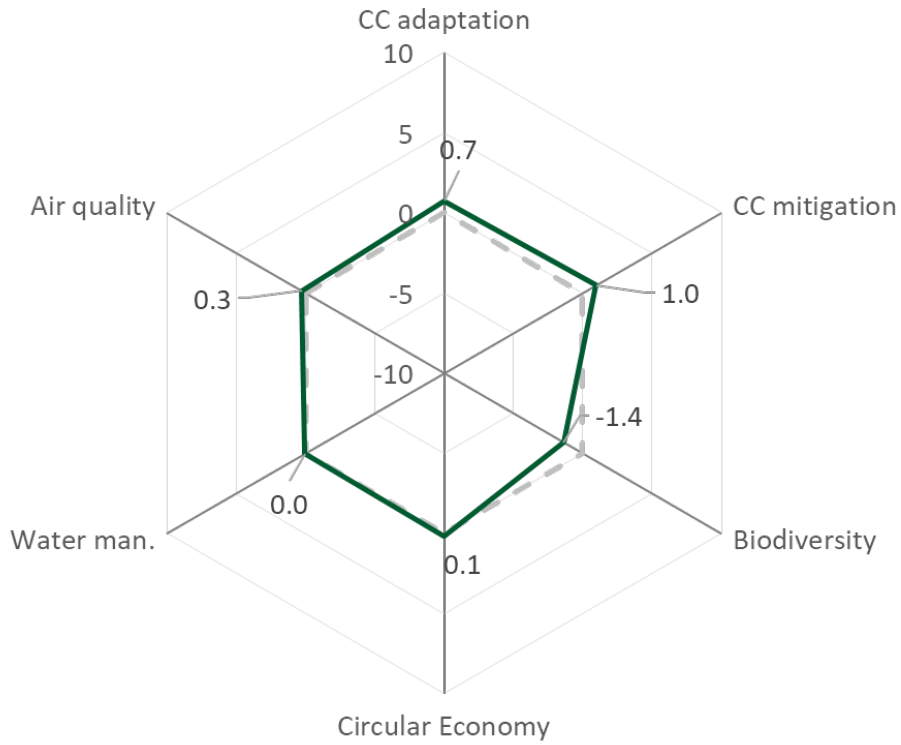
TOP NEGATIVE POLICIES FOR MITIGATION

Policy	Assessment	Value (£ bn)
Strategic roads investment from 2020 to 2025, delivering over 60 upgrades, including the Lower Thames Crossing - and major upgrades to the A66, A248, A417 and A12	N2	22
Fuel Duty: One year freeze in 2022-23	N2	7
Affordable Home programme	N1	7

Figure 6

Top positive and negative policies for mitigation – Autumn 2021 Budget and CSR

The Autumn 2021 Budget and CSR performs relatively ‘neutrally’ across all six environmental criteria, except biodiversity, where large infrastructure spending has the potential to damage natural environments unless significant mitigation measures are put in place. This is shown in Figure 7 below. The Budget Tagging index score is calculated by dividing the fiscal value of relevant policies against the total value of the entire budget. A score greater than zero shows that the Budget promotes policies that are generally expected to have a positive effect on that environmental outcome; while a value less than zero suggests that the fiscal position is overall pushing in an environmentally damaging direction. In general, this index score tends strongly to zero given the high proportion of environmentally neutral tax and spending announcements. Figure 7 also includes the results of the budget tagging exercise for all six environmental categories: the number of relevant fiscal decisions, their relevant tag, and the monetary value ascribed to those decisions.



	Tagging result	Adaptation	Mitigation	Biodiversity	Circular economy	Water management	Air quality
Number of relevant fiscal decisions	P2	9	23	5	0	5	24
	P1	7	20	18	4	1	12
	Z	266	216	244	278	276	223
	N1	0	16	12	1	0	18
	N2	1	8	4	0	1	6
Absolute value of relevant fiscal decisions (£ billions)	P2	10	22	1	0	1	19
	P1	20	94	33	8	0	40
	Z	2632	2489	2547	2653	2660	2547
	N1	0	23	55	0	0	48
	N2	0	32	27	0	0	8

Figure 7
Autumn 2021 Budget and CSR - Budget Tagging results index and summary

ii. Comparison with March 2021 Budget Tagging Results

It is difficult to compare the tagging index results between the March 2021 and Autumn 2021 Budgets because the Autumn Budget is significantly bigger, and with many neutral policies strongly pushing both indices to zero. Nonetheless, the comparison shows a generally more positive picture for the Autumn 2021 Budget and CSR in comparison to the March Budget. The differences are largely driven by the longer-term infrastructure investments announced as part of the Comprehensive Spending Review.

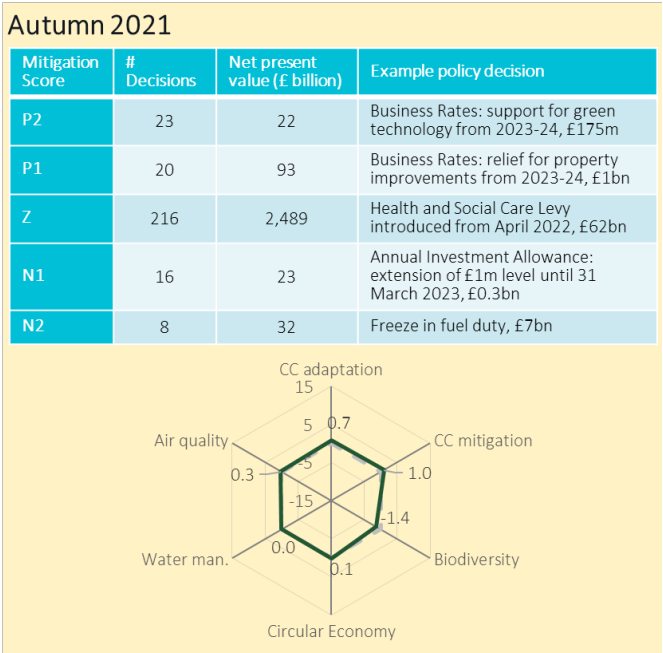
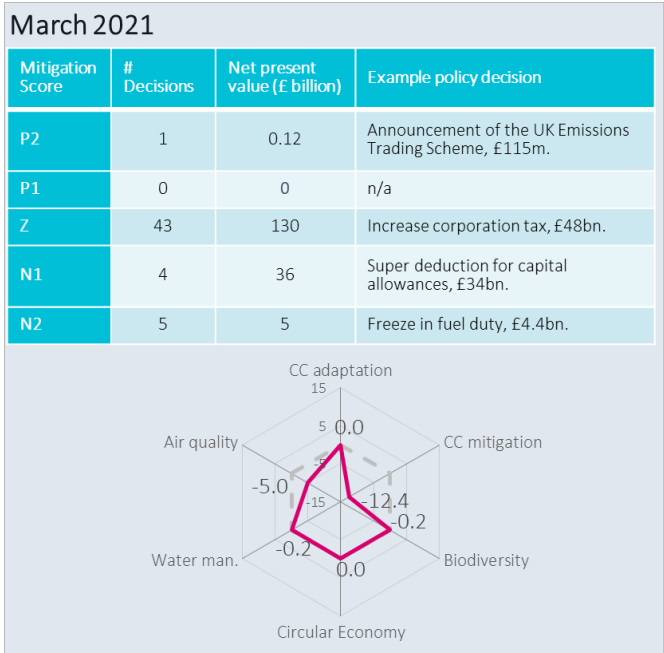


Figure 8
Comparing Budget Tagging Results – March 2021 and Autumn 2021



<https://www.hs2.org.uk>

B. EMISSIONS ESTIMATES

i. Results from March 2021

The Emissions Estimate Tool confirms the indication from the Budget Tagging Tool that the March 2021 Budget is expected to increase UK emissions in the short-term. As the ‘net emissions’ data point in Figure 9 shows, the March 2021 Budget is initially expected to increase UK emissions. This is driven by the economic stimulus and recovery policies, notably the capital allowance super deduction, which stimulate the economy without directing it towards a sustainable pathway. In addition to stimulus policies, environmentally-harmful policies such as the decision to freeze the Carbon Price Support and fuel duty also increase emissions. From the 2023-24 fiscal year, the announcements made in the Budget are expected to lower emissions. This is partially driven by the UK emissions trading scheme, but also the tax increases that have been introduced to repair public finance – these are expected to have a slowing effect on the economy and hence emissions.

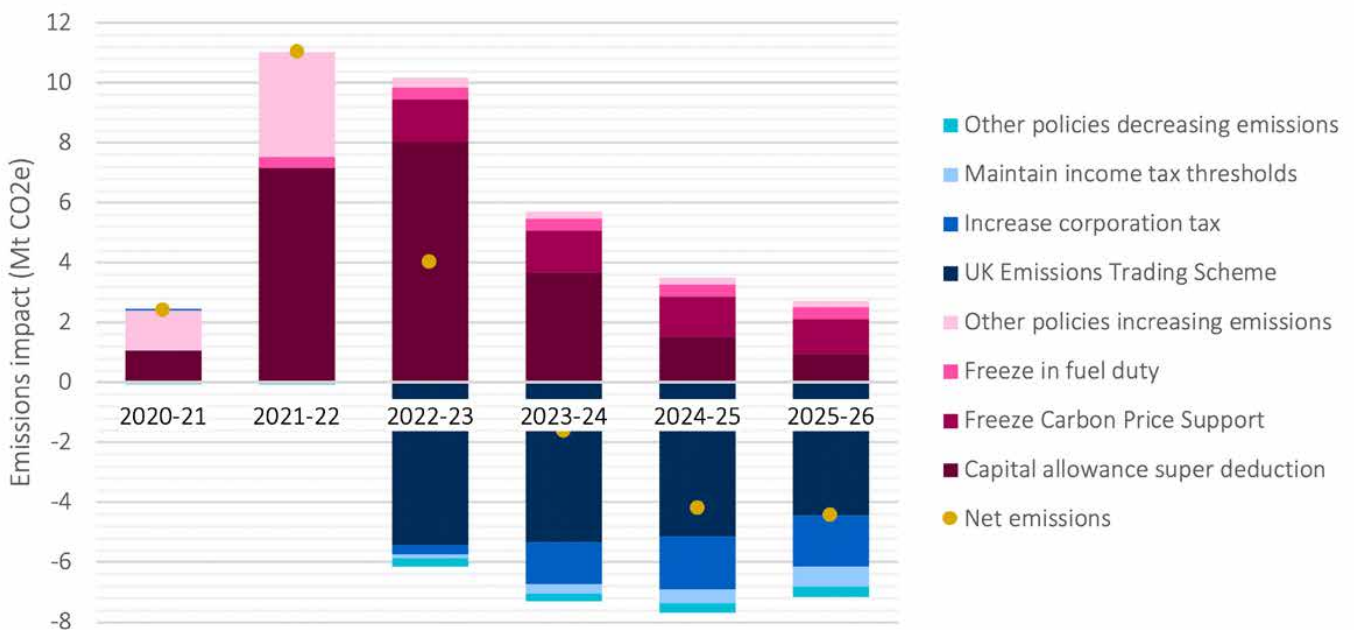


Figure 9
March Budget 2021 Emissions Estimate results – policy spotlight

ii. Results from Autumn 2021 Budget and CSR

The Autumn 2021 Budget and CSR sets a more positive direction for medium term emissions reductions through investment in R&D, energy, and transport investments. Figure 10 below shows the results of the emissions estimates over the new extended time period from 2020 to 2045. While net emissions do begin the period as positive, mitigation-positive investments (e.g. in housing efficiency upgrades, carbon capture, nuclear energy generation) push the overall net emissions into negative by 2025. This has the potential to set the UK economy on a more sustainable growth path, de-intensifying carbon intensive parts of the economy such as transport and energy, as long as future fiscal events also promote sustainable growth.

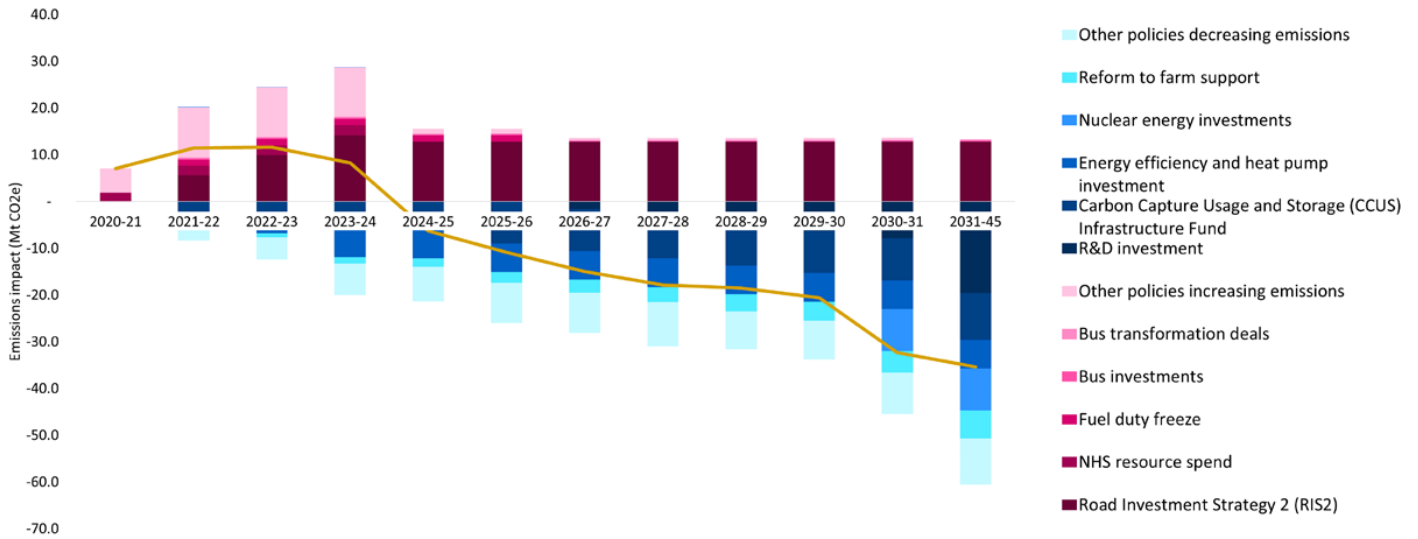


Figure 10
Autumn 2021 Budget and CSR emissions estimates results

Note: Note that 2031-2045 is shown as an annual average of the emissions estimates in those years. The significant decrease in emissions in 2026 is because of a lagged effect of an increase in public R&D expenditure. The emissions estimates for RIS2 are an average of the 60 year estimates from Freedom of Information Requests compiled by the Transport Action Network. This includes expected increases in the use of electric vehicles.

The most significant policies that reduce emissions are long term investments in R&D, accelerating carbon capture, and improving household energy efficiency.

The policies with the largest projected emissions savings over the entire 2021-2045 period are those that can make long term improvements to carbon intensity across sectors, such as investments in R&D and energy efficiency. The effects of these longer-term spending plans persist beyond the immediate years where the spending occurs, driving their higher impact. It is noteworthy that the majority of positive spend focuses on R&D which, while welcome, has uncertain benefits and does not deliver the near-term emissions reductions of more ‘shovel-ready’ projects, such as, for example, a properly funding energy efficiency retrofit programme. It is vital that Government act now by bringing forward policies that deliver near-term emissions reductions in order to avoid the worst impacts of climate change. Delaying the necessary investments by ten years is highlight inefficient, doubling the amount of investment needed to achieve the same reductions and creating an unnecessary financial burden for future generations.

Government could reduce the impact of policies that increase emissions by introducing ‘conditionality’ into departmental spending requirements.

The emissions estimates for the Autumn 2021 Budget and CSR are driven upwards by two types of emitting policies:

1. **Policies that indirectly increase emissions through increasing demand in emitting sectors.** These policies have no requirement for departments to spend this money on climate positive investments, and so lead to an increase in output in emitting sectors. This category makes up most of the short term increases in emissions, and it is why everyday departmental resource budgets are shown to increase emissions in the NZT.
2. **Policies that will likely increase the carbon intensity of the economy, for example encouraging more use of polluting goods and services.** Three policies that fall into the latter category include reductions in short haul air passenger duty, the freeze in fuel duty, and investments in new road infrastructure.

One of the biggest opportunities for future emissions reductions would be for government to ‘green’ the everyday resource spend of their departments. Pledges such as the NHS’ commitment to being net zero by 2045 will play an important part in reducing emissions from ongoing spend.⁷ Government can also seize this in future budgets by including conditionality on directly and indirectly polluting spending plans. This would require the department to consider climate mitigation actions while implementing their spending. For example, the UK Government could have attached green conditionality to commitments in the Autumn Budget relating to funding for skills training, apprenticeships and retraining opportunities for adults, thereby promoting the growth of skills that are essential to the net zero transition and will enable access to good jobs in the UK’s fast-growing green industries.

Another example of where conditionality could have a pronounced effect on carbon emissions is in the government’s investments in buses. It is notable that investments in the bus network are currently classified as an emitting policy, rather than a mitigating one, which may appear counterintuitive. This classification is because, while bus use does discourage use of heavier polluting transport modes such as private cars and taxis, it also draws passengers from less polluting rail transport and active transport options, and encourages people to take new trips that they might not otherwise have taken had the bus improvements not been made. While there are notable social benefits to this kind of investment, buses remain largely fuelled by fossil fuels, and as such have a relatively high emissions intensity. The policies could have a significantly higher mitigation potential if further conditionality were put in place to mandate use of low or zero emission buses. This would enable the social benefits of investments in the bus network to be delivered, while also reducing UK carbon emissions and increasing air quality.

More government action will be needed to decarbonize the UK’s economic growth in the long term. The pink bars below compare the emissions estimates for the Autumn 2021 Budget and CSR to the Climate Change Committee’s Net Zero Pathway, which is shown in light blue. It is notable that the Budget and CSR begins to support this Pathway from 2024-25, when many of the infrastructure benefits begin to be realised. Further reductions will be necessary, however, as we would expect future Budgets to deliver some short-term emissions increases through the emissions factors in standard departmental spend. Governments would also likely introduce more carbon-abating policy measures, however, which gives some ground for optimism, but this is challenging to predict. It will be important for government to consider a broad range of tools beyond fiscal policy to deliver further emissions reductions. These could include more financial incentives and regulatory changes.

COMPARISON OF AUTUMN 2021 BUDGET AND CSR AGAINST CCC NET ZERO PATHWAY

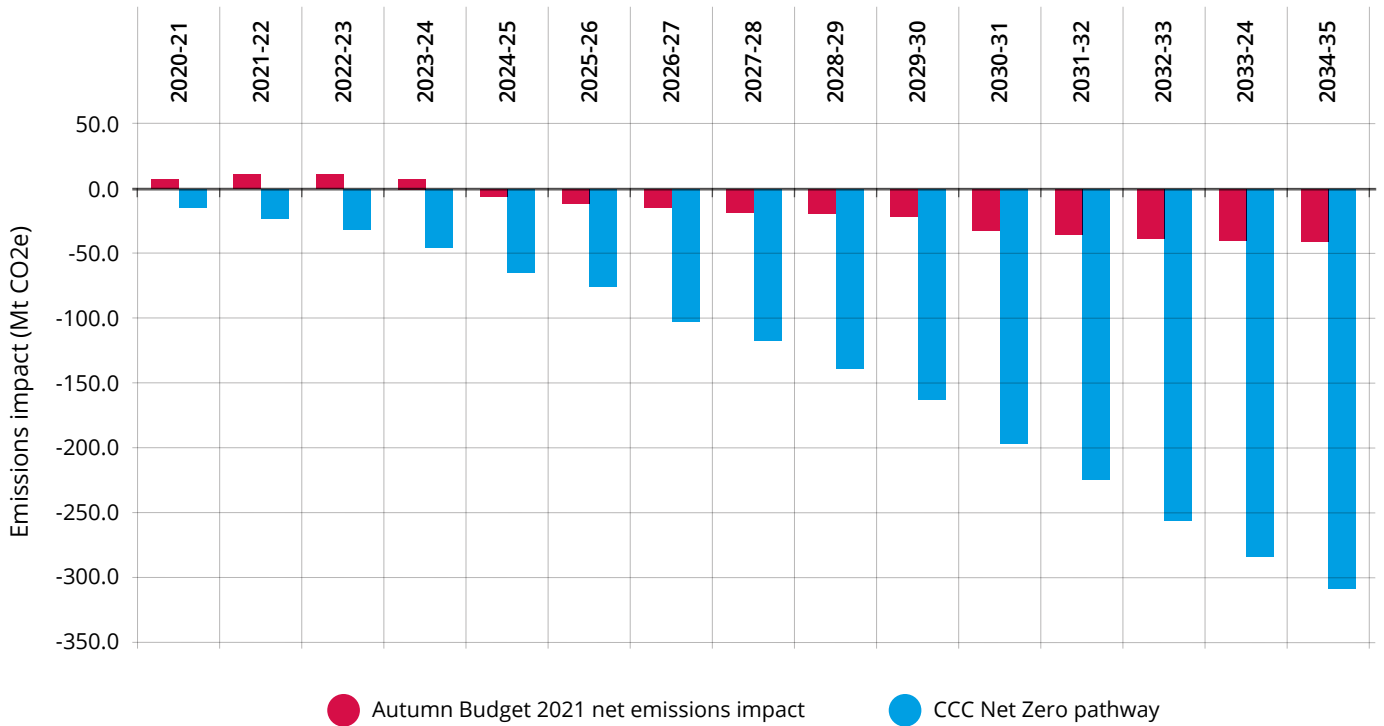


Figure 11
Comparing Autumn 2021 Budget and CSR against the CCC net zero pathway

iii. Comparing emissions estimates between the March and Autumn 2021 Budgets

The Autumn 2021 Budget and CSR is considerably bigger than the March 2021 Budget and drives net negative emissions through its spending plans. While difficult to completely compare the two Budget announcements in terms of size and content, the tables below begin to draw some comparisons. Key points include:

- The Autumn Budget allocates £2.6 trillion of spending over a six-year period, while the March Budget only allocated £46 billion.
- The Autumn Budget reduces net emissions by 745 MtCO₂e over an extended 25-year assessment period, while the March budget pushed up net emissions by 16.4 MtCO₂e over its six-year period. Spending decisions from the Autumn CSR are significantly more climate-positive than those from March. This includes significant spending on energy and transport infrastructure.

Despite these differences, the Autumn Budget and CSR reveals a much more climate-positive overall spend pattern, with negative net emissions per £ spent, compared to the positive emissions per £ spent in March.

Autumn 2021 Budget and CSR Overall Impact (2021-2045)

	Absolute value of policies (£bn)	Emissions created (ktCO ₂ e)	Emissions abated (ktCO ₂ e)	Net emissions (ktCO ₂ e)	Net emissions per £bn budgeted (ktCO ₂ e/£bn)
Total	2662	353073	-1098070-	- 744997	-280-
Spend	2485	345361	-1089971	-744610	-300
Tax	177	7712	-8098	-387	-2
Total	2662	353073	-1098070	-744997	-280
Budget	289	9972	-8147	1826	6
CSR	2372	343100	-1089923	-746823	-315

March 2021 Budget Overall Impact (2021-2026)

	Absolute value of policies (£bn)	Emissions created (ktCO ₂ e)	Emissions abated (ktCO ₂ e)	Net emissions (ktCO ₂ e)	Net emissions per £bn budgeted (ktCO ₂ e/£bn)
Total	46	101,704	-19,182	16,338	2,612
Spend	19	2,473	-43	2,431	129
Tax	27	23,506	-9,549	13,957	513

Table 4
Comparison of March and Autumn 2021 emissions estimates

When compared to progress against the CCC Net Zero Pathway, the Autumn Budget is more on track to deliver the required commitments over the long term than the March Budget, but there is still a significant gap. The Autumn Budget is forecast to deliver less than 12% of the overall emissions reduction required to align with the Net Zero Pathway. Public spending will only represent around 25% of the investment needed to deliver net zero, but it is essential that this spending is well-targeted and sufficient to deliver the emissions reductions needed. Further fiscal policies, regulation and financial incentives will also be needed to encourage the private sector investment necessary to deliver the remaining emissions reductions. Figure 12 below compares the March 2021 emissions estimates against the Autumn 2021 estimates and the CCC Net Zero Pathway. While some policies entail short-term emissions but deliver greater long-term emissions reductions, such as investment in low-carbon infrastructure, most policies that drive up emissions, such as cuts to domestic air passenger duty and the fuel duty freeze, have no medium-term environmental benefit and actively work against climate goals. Adopting a NZT would allow government to avoid the latter kind of policies or balance them out by delivering more ambitious emissions reductions elsewhere in the Budget.

COMPARISON OF MARCH 2021 BUDGET AND AUTUMN 2021 BUDGET AND CSR AGAINST CCC NET ZERO PATHWAY

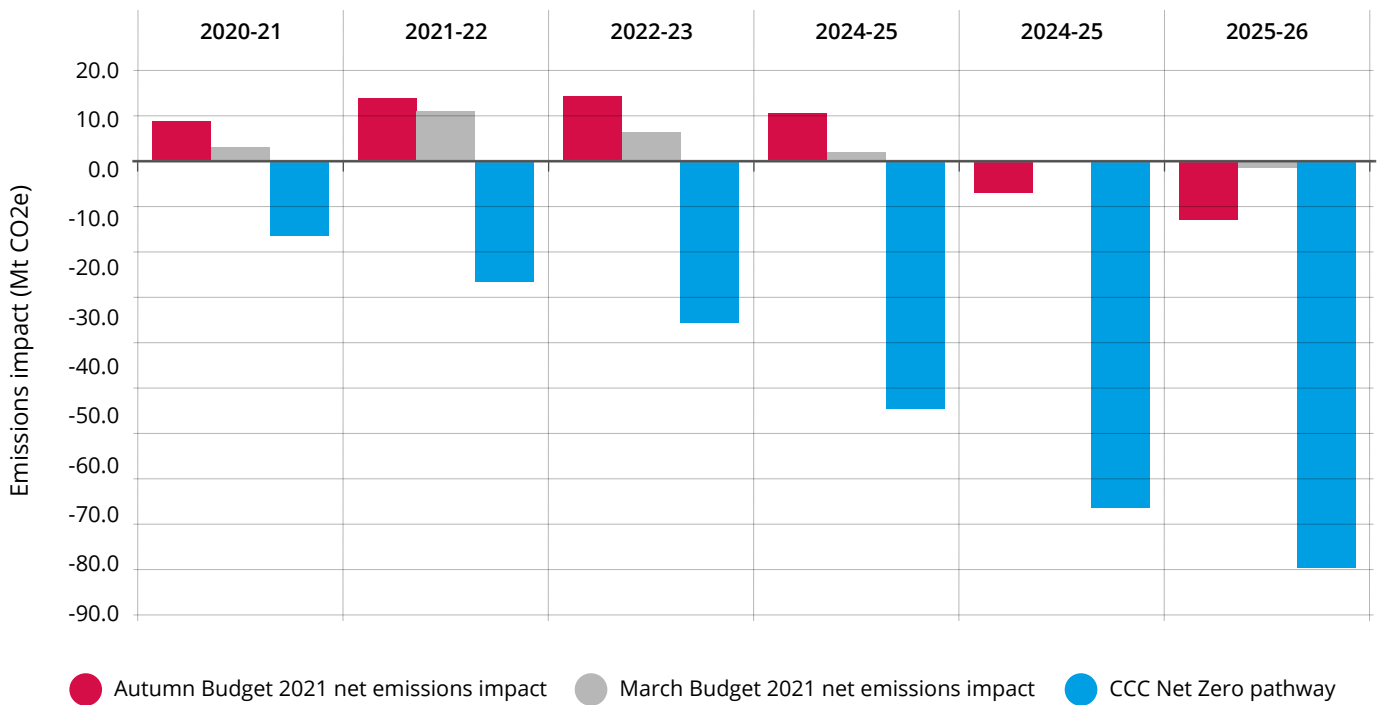


Figure 12
Comparing March and Autumn 21 emissions estimates against the CCC pathway

WHAT CAN INDIVIDUALS DO TO HELP?

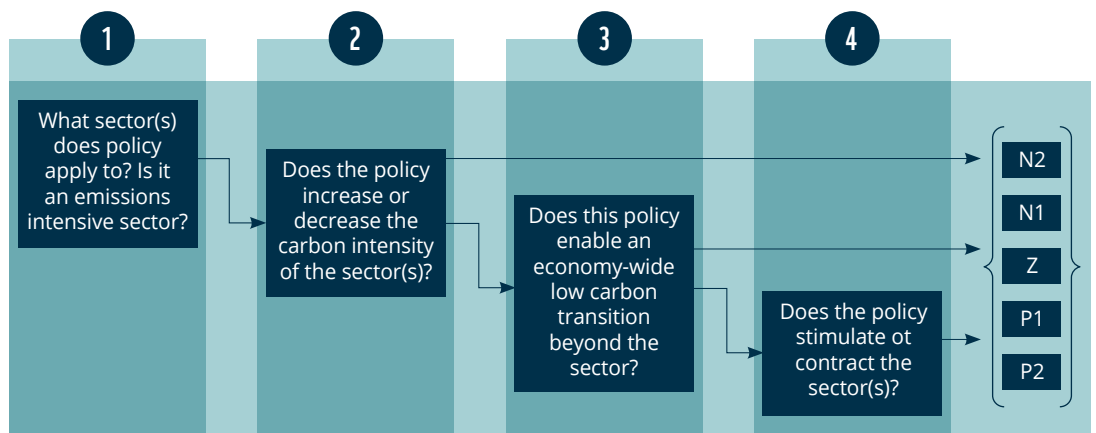
The UK Government has a legal obligation to deliver net zero, which will help limit global warming to 1.5°C and deliver a greener, more prosperous future for you and your children. Add your voice to WWF-UK's campaign below and write to your local MP, asking them to support a Net Zero Test to ensure that public money is spent on policies that protect nature, create jobs, and tackle dangerous climate change, not on the polluting industries of the past.



5. ANNEX – DETAILED APPROACH FOR EMISSIONS ESTIMATES AND BUDGET TAGGING

BUDGET TAGGING

Policies are scored using a four step process which considers the emissions intensity of the sector, the potential of the policy to alter the intensity of the sector, and the policy's broader contribution to the net zero transition. This gives a high level classification that is flexible and applicable to different types of policy decisions, whether or not they are explicitly environmentally relevant. The criteria described below allows the tagging to capture both policies which have a direct effect on emissions and those that have an indirect effect of growing a high emission economy. For example, a policy that stimulates growth in an emissions-intensive sector without reducing its carbon intensity will have an N1 tagging. The decision tree below shows the order in which these questions are considered in the tagging process.



EMISSIONS ESTIMATES

TRANSFERS TO/FROM HOUSEHOLDS

Emissions from transfers to and from households have been estimated using Marginal Propensity to Consume (MPC). Two multipliers are used to represent the different groups of households that policies impact:

1. A MPC for social safety net programmes of 0.94, derived from the literature, that applies to policy supporting low-income households
2. The OBR Tax multiplier for policies impacting household income tax

Approach



Examples

Policy decision	Multiplier	Sector	Emissions factor ($kCO_2e/£m$)	Final Emissions estimate (kCO_2e)							
				Y1	Y2	Y3	Y4	Y5	Y6	Total	
Household Support Fund	State transfers to low income households	0.94	Consumer Expenditure	0.07	0	5	5	5	0	0	16
Capital Gains Tax: increase property disposal payment window from 30 to 60 days	Taxes on household income	0.33	Consumer Expenditure	0.07	0.07	0.01	0.01	0.01	0.01	0.01	0.1

TRANSFERS TO/FROM BUSINESSES

Transfers to and from businesses have been estimated using the OBR’s tax multiplier.



Examples

Policy decision Unit	Multiplier	Multiplier	Sector factor	Emissions ($kCO_2e/£m$)	Final Emissions estimate (kCO_2e)						
					Y1	Y2	Y3	Y4	Y5	Y6	Total
Business Rates: 50% relief for retail, Hospitality and Leisure Sectors in 2022 - 23, £110,000 cash cap 7	OBR - Tax	0.33	All	0.14	0.00	-0.18	5.19	4.97	5.13	5.28	20
Museum, Galleries and Exhibition Tax Relief (MGETR) sunset clause: extend to March 2024	OBR - Tax	0.33	All	0.14	0.00	0.00	0.05	0.10	0.05	0.00	0.2

SPENDING ON PUBLIC SERVICES

Public service policies are assumed to result in an economic impact equivalent to the spending amount and use a multiplier of one.



Examples

Policy decision	Multiplier	Sector	Emissions factor ($kCO_2e/£m$)	Final Emissions estimate (kCO_2e)						
				Y1	Y2	Y3	Y4	Y5	Y6	Total
Create a network of family hubs to improve access to services for families	0.3	Education	0.03	0.00	0.00	0.00	0.15	0.00	0.00	0

PUBLIC PROGRAMMES

Public programmes are assumed to impact the economy in line with the OBR’s multiplier for departmental spending.

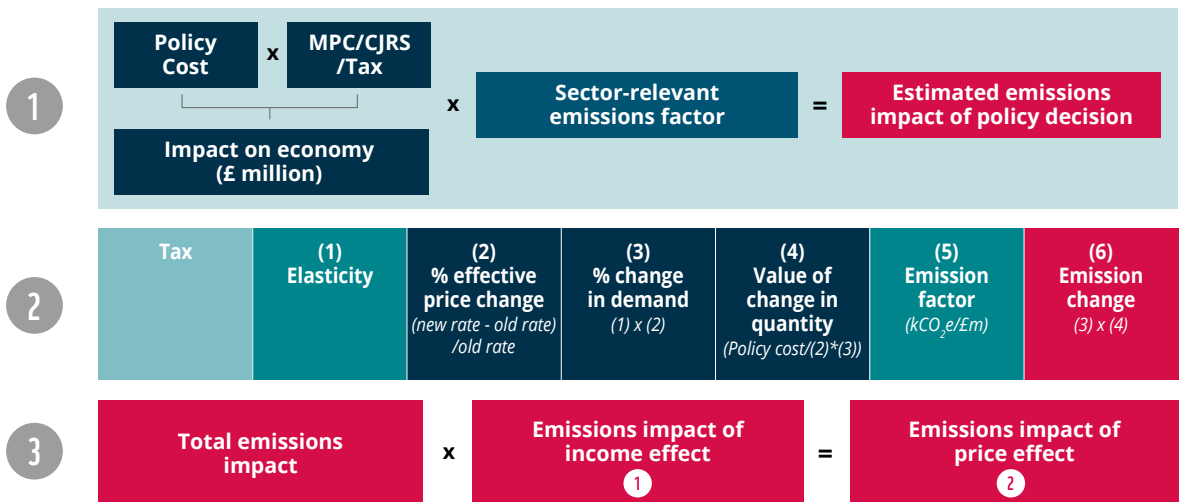


Examples

Policy decision	Multiplier	Sector	Emissions factor (kCO ₂ e/£m)	Final Emissions estimate (kCO ₂ e)						
				Y1	Y2	Y3	Y4	Y5	Y6	Total
Build 40 new hospitals and upgrade over 70 hospitals	0.34	All	0.14	-	52	52	52	-	-	155

INDIRECT TAXES

Emissions from indirect taxes are calculated using multipliers to capture the income effect and price elasticities to capture the impact on demand. Either household or business multipliers, whichever relevant, are applied to the policy to estimate the income effect. In addition, elasticities are applied to policies with price effects to estimate their impact on quantity demanded of the good. Both impacts are then multiplied by the relevant emissions factor to estimate the change in emissions.



Examples of emissions estimates of indirect tax policies; fuel duty and changes to the air passenger duty, as shown by the calculation steps below¹⁹:

ENERGY INFRASTRUCTURE

The emissions impact of energy infrastructure is the sum of the construction emissions of the project and the emissions saved through replacing gas energy generation capacity on the grid with new generation capacity.. Construction emissions are calculated using the cost of the policy, multiplied by the construction emissions factor. The emissions from the new energy generation are calculated using reported new generation capacity provided by the policy spending and the associated emissions impact of that power generation.

1. Estimate impact of construction

$$\text{Emissions impact} = \text{Cost of construction} \times \text{Construction emissions factor}$$

1. Estimate impact of change in energy supply

$$\text{Emissions impact} = \text{Total capacity of project} \times \text{Emissions factor for energy generation} - \text{Emissions to produce = capacity with gas}$$

CARBON CAPTURE USAGE AND STORAGE INFRASTRUCTURE FUND

Carbon capture usage and storage (CCUS) will capture 10MtCO₂ per year by 2030, according to the Net Zero Strategy. The CCC provides a suggested pathway for capturing and storing industrial emissions, from 3 MtCO₂ per year to 6 MtCO₂ by 2030, and 9 MtCO₂ per year by 2035.²⁰ The Tool uses the CCC pathway to indicate the scaling up of CCUS capacity, reaching 10Mt per year by 2030.

1. Estimate impact of construction

$$\text{Emissions impact } 434 \text{ ktCO}_2\text{e} = \text{Cost of construction } (\pounds 3,000 \text{ million}) \times \text{Construction emissions factor } (0.11 \text{ ktCO}_2\text{e}/\pounds \text{ million})$$

2. Emissions saved from CCUS investment

$$\text{Emissions impact } -212,000 \text{ ktCO}_2\text{e} = \text{Final emissions estimate (ktCO}_2\text{e per year)}$$

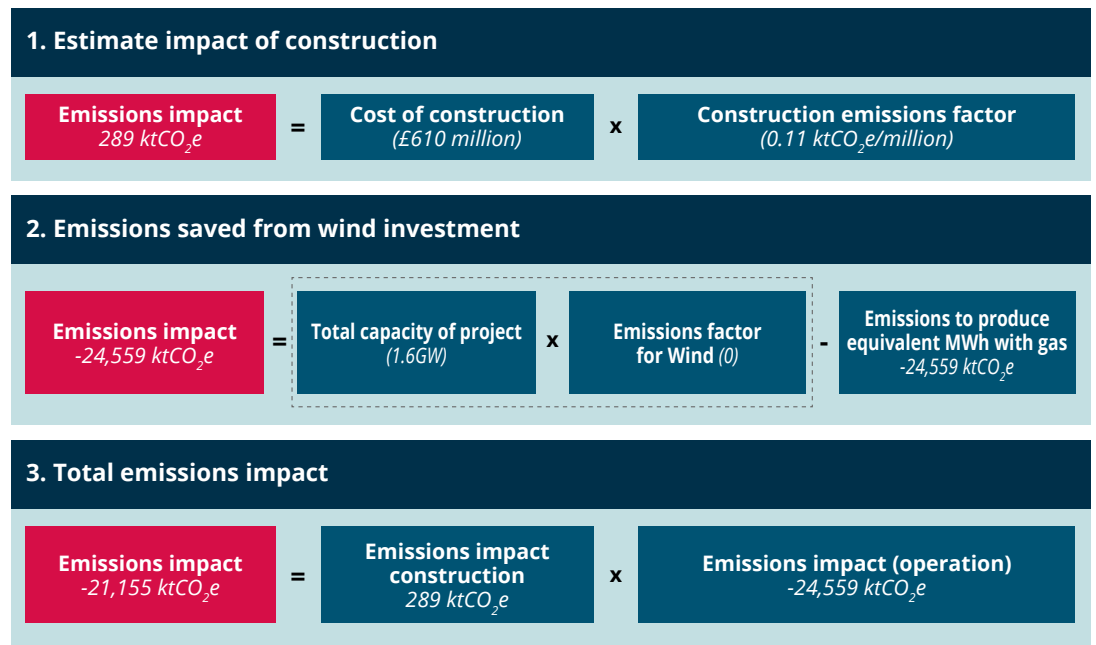
Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12-25
			-		-						
-0	-3,000	-3,000	-6,000	-6,000	-9,000	-9,000	-9,000	-9,000	-9,000	-9,000	-10,000

1. Total emissions impact

$$\text{Emissions impact } -211,566 \text{ ktCO}_2\text{e} = \text{Emissions impact (construction) } 434 \text{ ktCO}_2\text{e} \times \text{Emissions impact (operation) } -215,000 \text{ ktCO}_2\text{e}$$

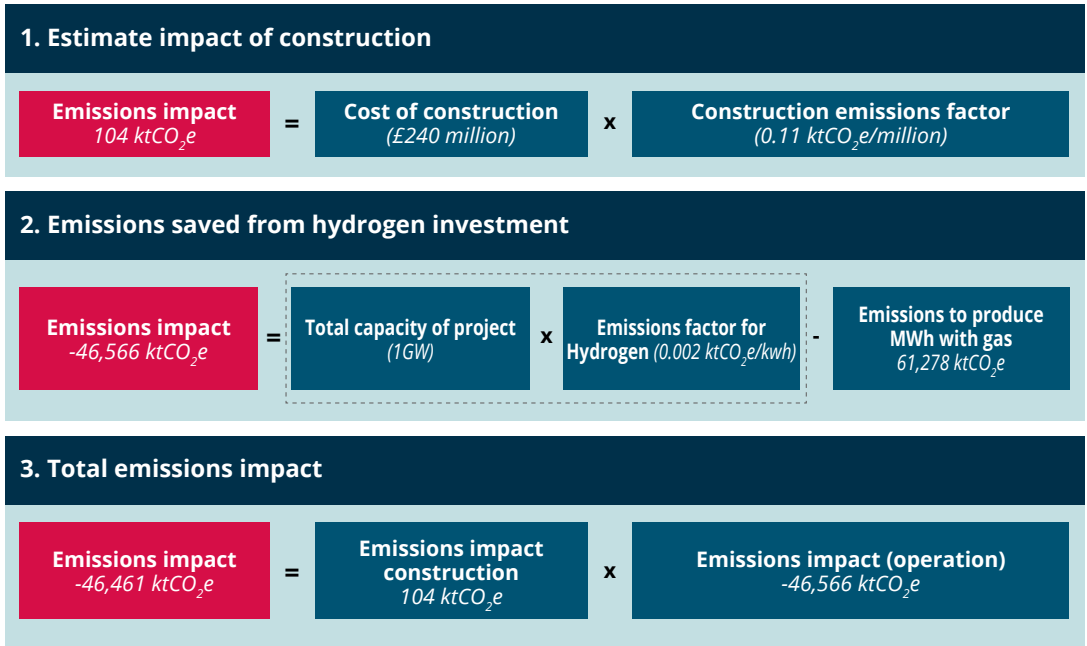
OFFSHORE WIND

The UK Net Zero Strategy states that the UK will generate 40GW of offshore wind energy by 2030, 1GW of which will be floating offshore wind. We have assumed that the spending in the SR will generate 1GW of the wind capacity, the generation of which will produce no emissions. Spending on wind generation therefore decreases emissions by the amount of emissions it would take to produce the same amount of electricity with gas power, with the emissions from the construction taken away.²¹ The example below is spending for the UK's world-leading offshore wind sector.



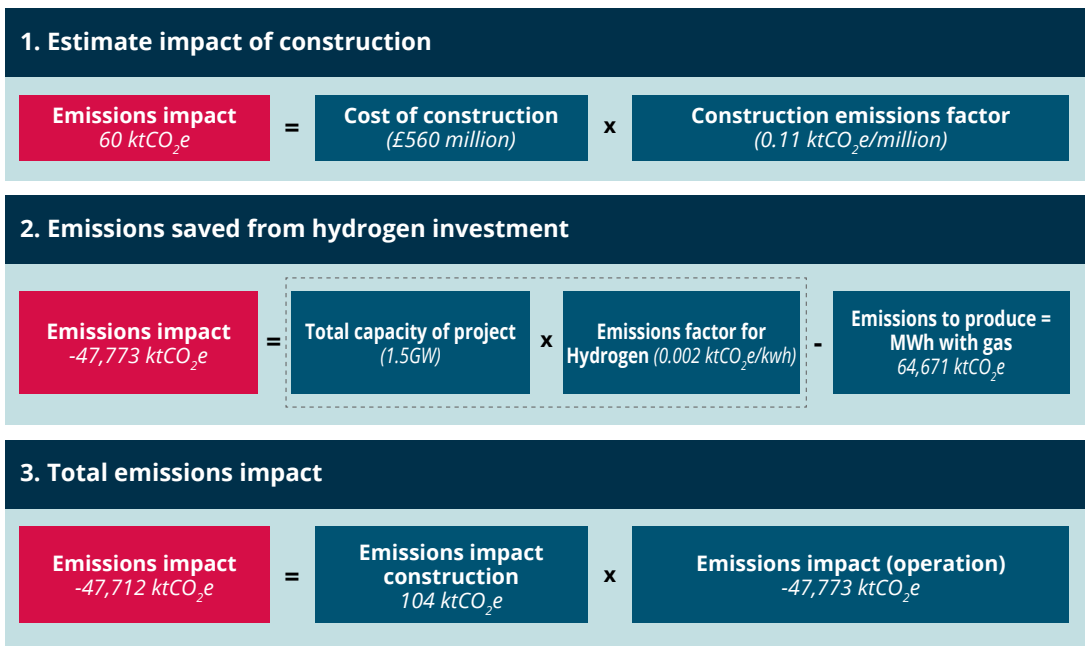
NET ZERO HYDROGEN FUND

The UK Net Zero Strategy states that the Net Zero Hydrogen Fund will fund 1GW of hydrogen production capacity by 2025. The UK aims to fund 100MW in 2023, 400MW in 2024, and we therefore assume the remainder of the 1GW capacity, 400MW, will be funded in 2025. We made the conservative assumption that all hydrogen produced will be blue hydrogen. Spending on hydrogen generation therefore decreases emissions by the amount of emissions it would take to produce the same amount of electricity with gas power, with the emissions from the construction taken away.



INDUSTRIAL DECARBONISATION AND HYDROGEN REVENUE SUPPORT SCHEME

The UK Net Zero Strategy states that the IDHRS will fund 1.5GW of hydrogen production capacity in 2023. We made the conservative assumption that all hydrogen produced will be blue hydrogen. Spending on hydrogen generation therefore decreases emissions by the amount of emissions it would take to produce the same amount of electricity with gas power, with emissions from the construction taken away.



NUCLEAR

The government is looking to develop the Sizewell C nuclear plant. This funding supports this process. If successful, EDF has estimated that the project will save 9 million tonnes of CO₂e per year in comparison to gas power station.²² The power station will come into operation in the early 2030s. The emissions impact of this spending is therefore the yearly savings from emissions when the plant becomes operational plus emissions impact of the plant construction.²³

1. Estimate impact of construction

$$\text{Emissions impact } 60 \text{ ktCO}_2\text{e} = \text{Cost of construction } (\text{£}560 \text{ million}) \times \text{Construction emissions factor } (0.11 \text{ ktCO}_2\text{e/million})$$

2. Emissions saved from nuclear investment

$$\text{Emissions impact } -135,000 \text{ ktCO}_2\text{e} = \text{Annual saving for 15 years } -9,000 \text{ ktCO}_2\text{e}$$

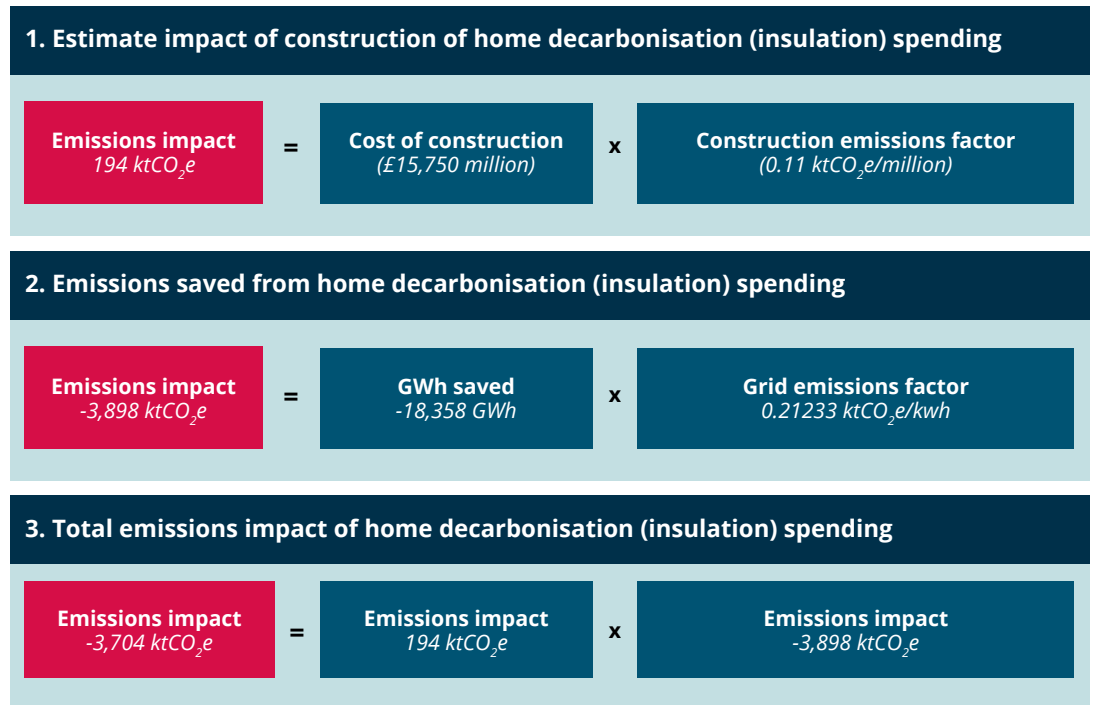
3. Total emissions impact

$$\text{Emissions impact } -134,939 \text{ ktCO}_2\text{e} = \text{Emissions impact construction } 60 \text{ ktCO}_2\text{e} \times \text{Emissions impact (operation) } -135 \text{ ktCO}_2\text{e}$$



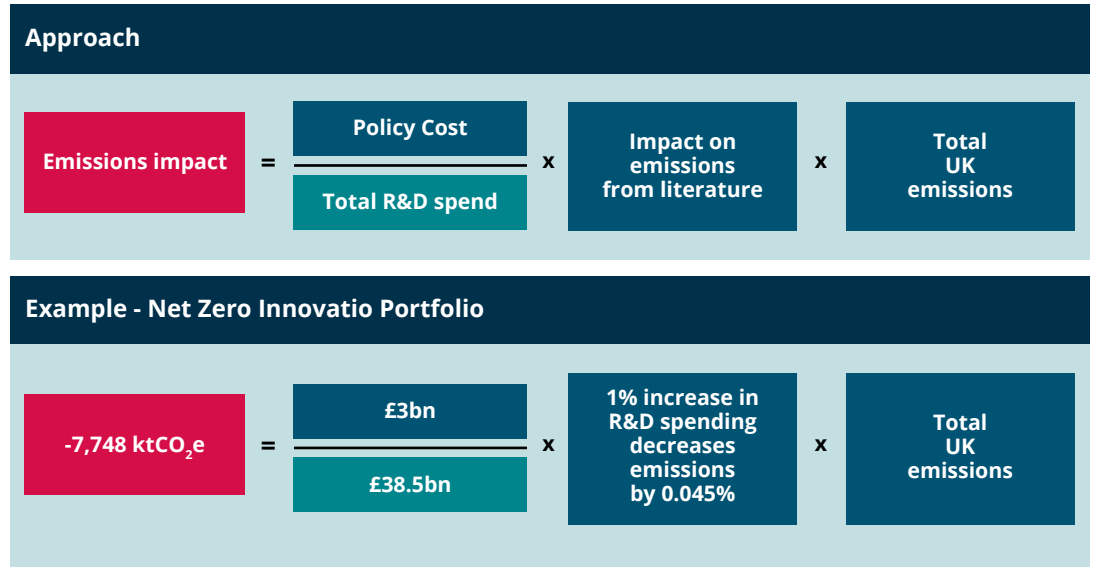
ENERGY EFFICIENCY

The spending for energy efficiency was announced as a lump sum in the spending review. The Net Zero strategy broke this down into spending buckets, including spending on decarbonising public sector buildings and home upgrades to insulation and heat pumps. We estimated the emissions of installing these items and used the CCC's estimates of energy saved by these measures and converted this to emissions using the emissions factor of the grid. The example below demonstrates this approach for spending on home decarbonisation.



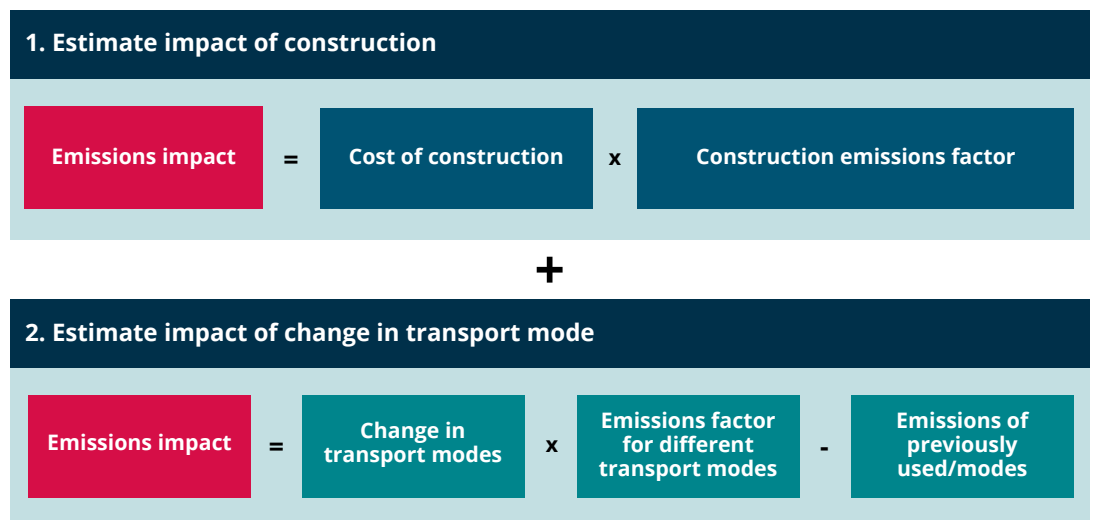
RESEARCH AND DEVELOPMENT SPENDING

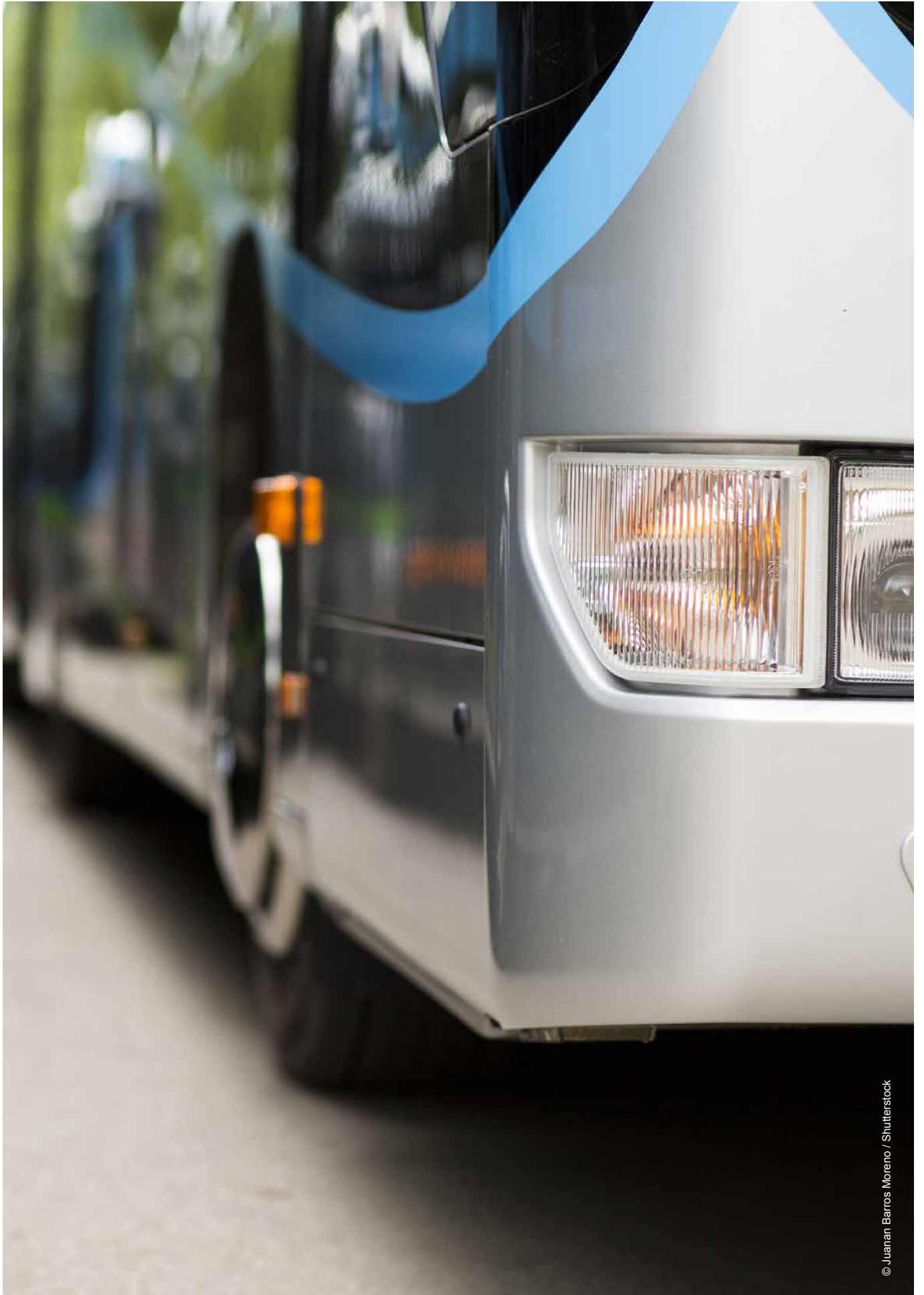
The emissions estimate for research and development spending was calculated using estimates of the impact of R&D on emissions in the UK from academic literature. The approach used results from research by Shabaz et al. (2020) which found that a 1% increase in R&D spending decreases emissions in the UK by 0.045%.²⁴ This was applied to all R&D spending items in the budget and spending review.



TRANSPORT INFRASTRUCTURE

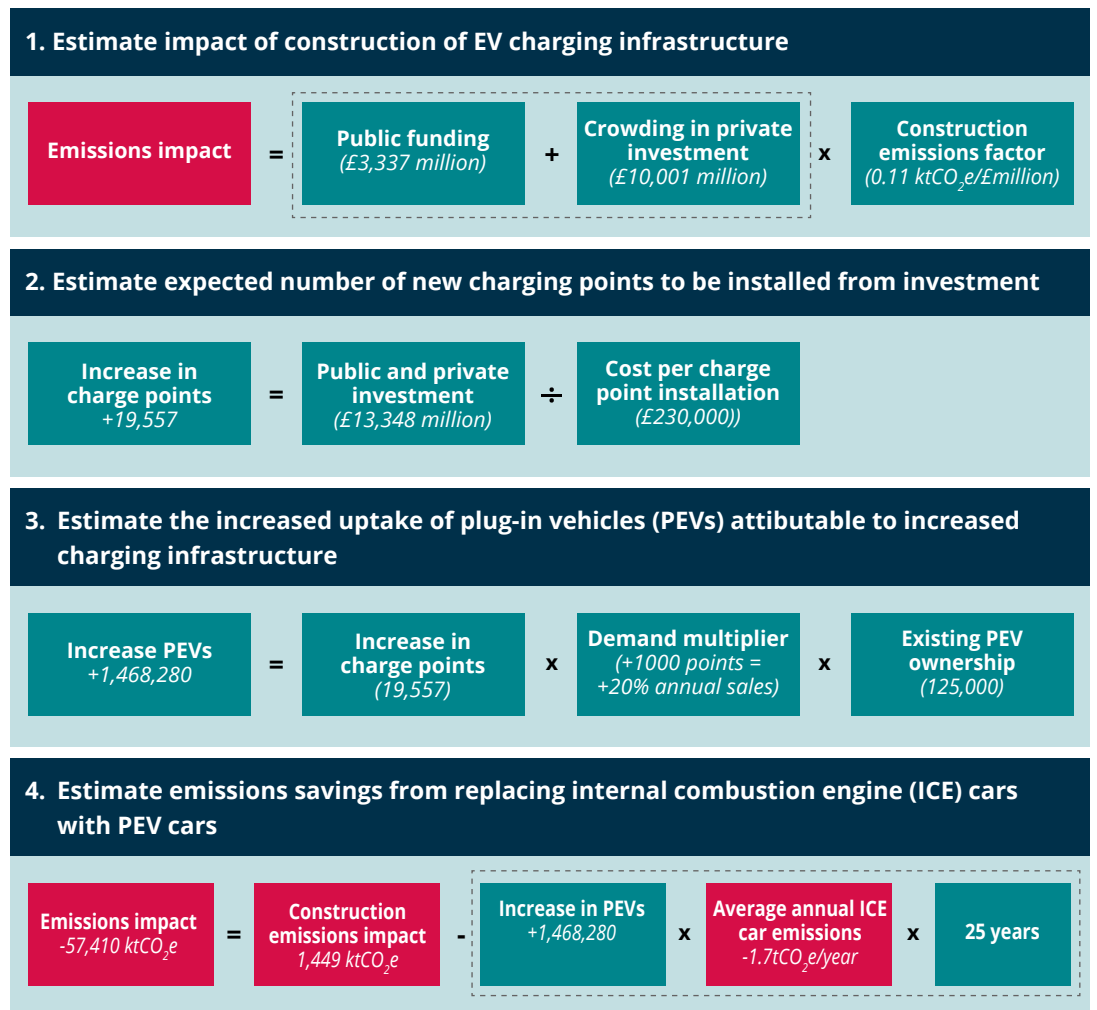
The emissions impact of transport infrastructure is calculated by the sum of the construction of the project and considering how consumers will change their journey patterns based on this new infrastructure. Construction emissions are calculated using the cost of the policy, multiplied by the construction emissions factor. When people change their mode of transport for particular journeys, the emissions factor of their journeys will also change. Public transport, for example, generally has a lower emissions factor per passenger km than use of personal vehicles. If more people use public transport options for their journeys, then the overall emissions of those journeys should decrease. We estimate this effect by considering the ‘modal shift’ between different transport options.





ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

The government committed funding for two policies explicitly linked to electric vehicle (EV) charging infrastructure in the CSR: £2.5bn for network installation, and £800m of investment into the EV supply chain. A larger charging network should encourage more people to shift modes from internal combustion engine (ICE) cars, to use of plug-in electric vehicles (PEVs).²⁵ Research from the World Bank in China suggests that investing in charging infrastructure is one of the most cost-effective methods for governments to encourage greater use of PEVs, and they estimate that an increase of 1,000 charging points should lead to a 20% increase in the annual demand for PEVs.²⁶ We calculate our emissions savings from the charging network by considering how many additional charge points these programmes could potentially fund.



RAILWAY INVESTMENT

The CSR contains a variety of railway investments, including High Speed Two (HS2), funding for essential services threatened by Covid-19, and initiatives to re-open underused railway stations. As with other infrastructure policies, we estimate emissions by combining construction emissions with changes to user behaviour as a result of the new infrastructure. We estimated a total of 35bn km of passenger travel that would use the enhanced railway services using estimates from the National Infrastructure Strategy, HS2 demand modelling, and other Department of Transport (DfT) strategy documents.²⁷ Using standard modal shift estimates from transport business cases, including HS2, we estimated how many of these passenger kms would be new journeys, and how many would transfer to the service from other modes (notably older inefficient rail, car, and aeroplane). We assume that all rail journeys under these new spending will use efficient trains with high degrees of electrification.

1. Estimate impact of construction of railway infrastructure

Emissions impacts
4,792 ktCO₂e

=

Public funding
(£44,132 million)

x

Construction emissions factor
(0.11 ktCO₂e/million)

2. Estimate impact on railway and other modal demand

	Mode share	Emissions factor <i>(ktCO₂e/billion passenger km)</i>	Passenger km projections (billions)											
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12-Y25
Total annual passenger kms	-	-	-	-	-	-	24	26	28	30	32	35	35	35
Switching from traditional rail	69%	20.62	-	-	-	-	16.56	17.82	19.18	20.63	22.20	23.89	23.89	23.89
New trips	26%	8.00	-	-	-	-	6.24	6.71	7.23	7.78	8.37	9.00	9.00	9.00
Shift from air	1%	114.66	-	-	-	-	0.24	0.26	0.28	0.30	0.32	0.35	0.35	0.35
Shift from car	4%	154.53	-	-	-	-	0.96	1.03	1.11	1.20	1.29	1.39	1.39	1.39

3. Estimate emissions savings from changes in emissions factors of transport modes

Emissions impact
-3,345 ktCO₂e

=

Construction emissions impact
4,792 ktCO₂e

+

Change in mode

x

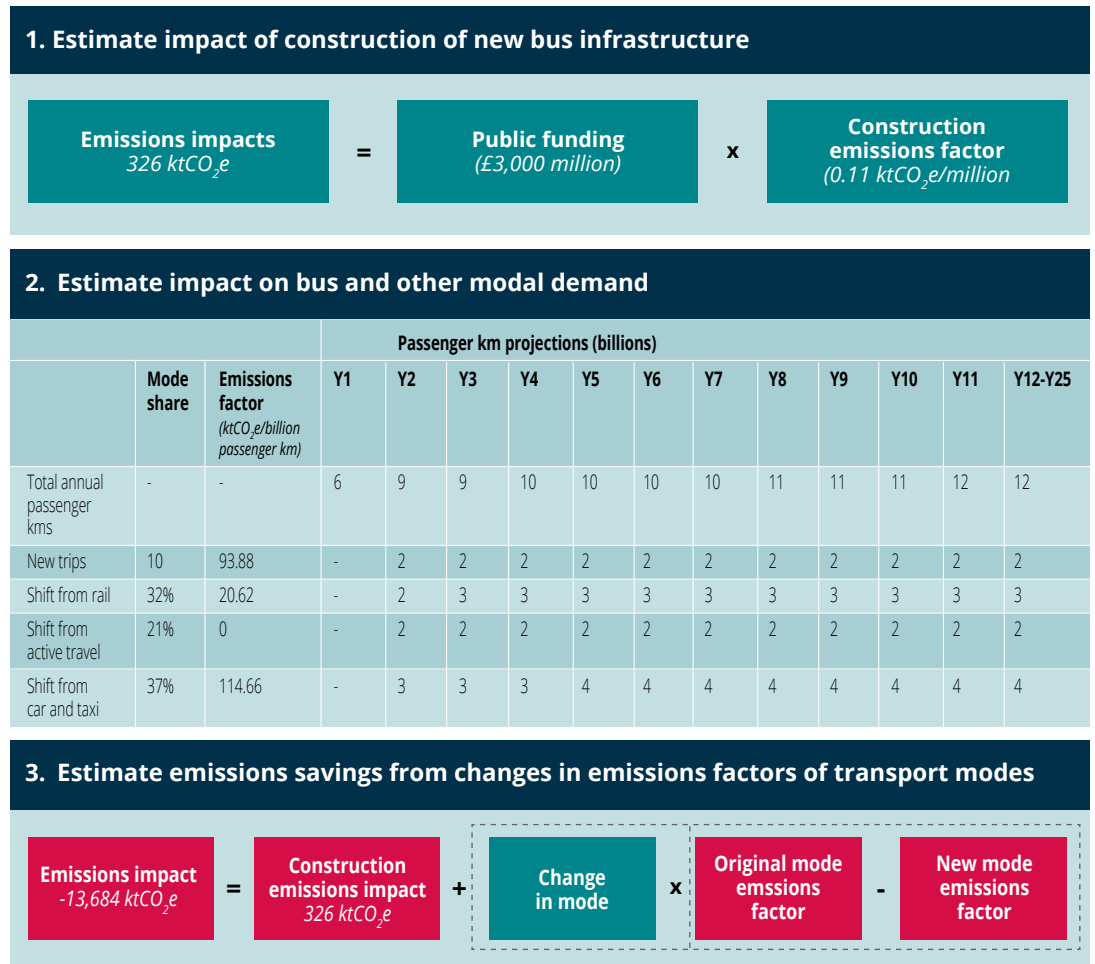
Original mode emissions factor

-

New mode emissions factor

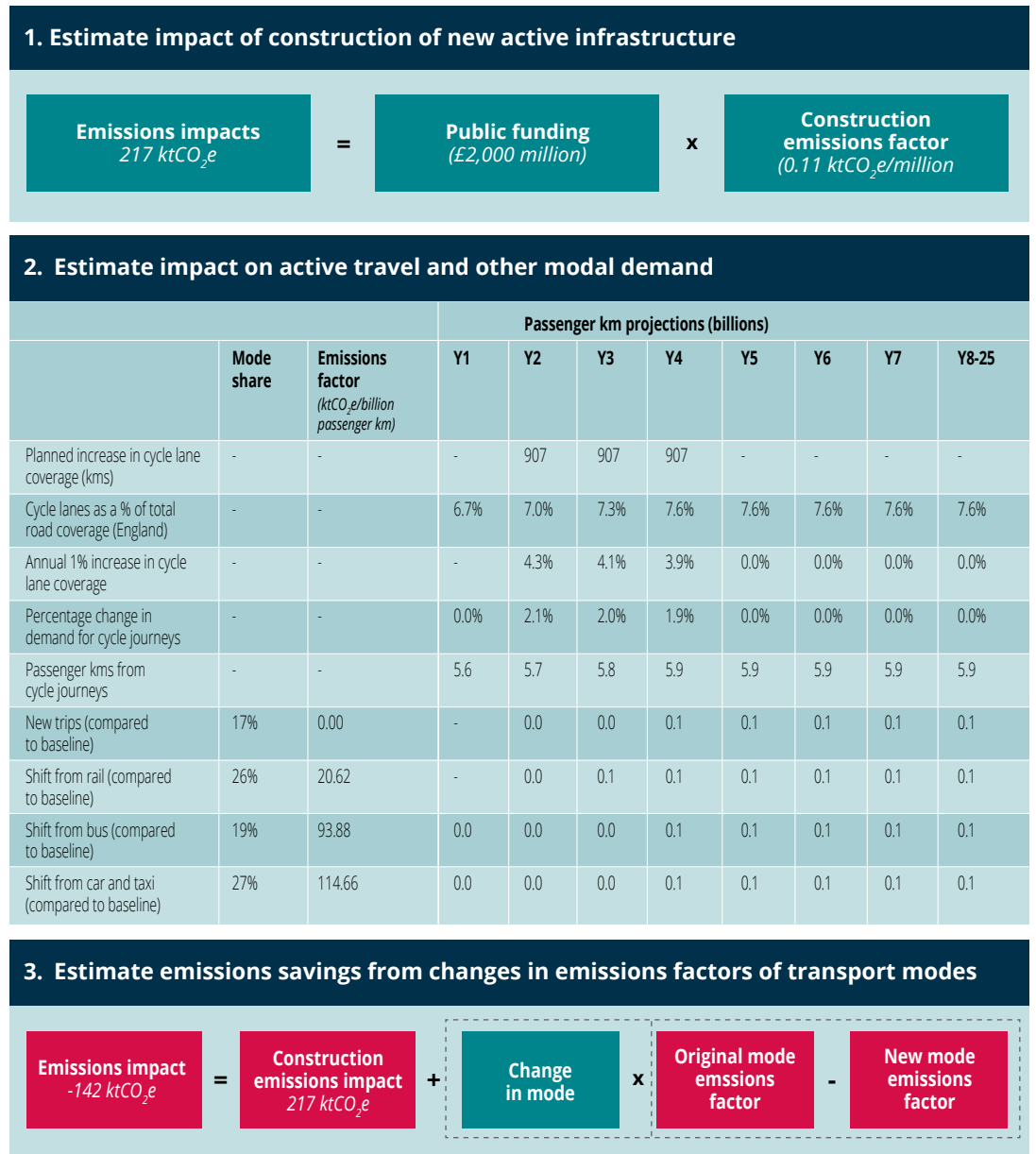
BUS INVESTMENT

The CSR contained several commitments to bus transport that had been discussed in the government’s ‘Bus Back Better’ strategy for buses, including £3bn announced for a transformation programme for bus networks outside of London.²⁸ These transformations will involve digitising the service and improving payment options, increasing speed and reliability with bus lanes, and back-office transformations to generally improve the cohesion of services (as has been successfully implemented in London, for example). This investment is likely to modernise the service and help the bus network recover from Covid. It will establish ‘TfL-style’ travel authorities in eight city regions. To estimate the emissions impact, we assume a growth rate in metropolitan bus use outside of London based on London’s growth in bus use after TfL was established. We use standard transport analysis guidance (TAG) from DfT to decide the extent of modal shift expected from this growth.²⁹ We see that the bus investments increase total emissions, since buses are relatively high emitters compared to rail and active travel, and the modal shift away from cars and taxis (which have higher emissions than buses) is not strong enough to reduce emissions. The emissions effect would have been positive if green conditionality had been attached, ensuring that funds were spent on zero emissions buses.



ACTIVE TRAVEL INVESTMENT

The CSR contained commitments to expanding the coverage of cycle lanes by ‘hundreds of miles’ over the spending review period using funding of £710 million – we assume that this builds 600 miles of cycle lane.³⁰ With an additional pot of £1.3 billion also assigned to encourage cycling and walking, we have assumed that the cycle network will scale up proportionally. Overall we assume an increase in cycle path coverage of 2,720km across the CSR period. DfT’s transport analysis guidance Unit 5.1 provides an elasticity for the change in demand for cycling in a district, based on a change in the proportion of route that has facilities for cycle traffic (0.05).³¹ Using this elasticity, we can estimate the overall increase in cycle journeys, and using standard TAG mode shares we can then assume the transport modes from which the cyclists have switched. This provides us with the emissions savings from increased active travel choices.



ROAD INVESTMENT

We have assessed the impact of the Road Investment Strategy 2020-2025 (RIS2) using data from a set of Freedom of Information (FOI) claims submitted by Transport Action Network while reviewing the environmental impact of the proposed road building plans. These FOI claims revealed that the estimates for all 50 projects in RIS2 would be 36 MtCO_{2e} over the 60-year lifespan of the roads. This estimate is notably different from the 0.27 MtCO_{2e} presented in the DfT case for RIS2. We lay out some of the methodological differences below. We have preferred the estimates from the Transport Action Network assessments, given that they are built 'bottom up' using real appraisal data from Highways England, offer a full picture of all the RIS2 projects, and capture more of the period that we analyse in our emissions estimates.

DEPARTMENT FOR TRANSPORT ESTIMATES

Government estimates show that RIS2 investments are expected to create an additional 0.27 MtCO_{2e} by 2032.³² DfT's methodology is consistent with DEFRA's Emissions Factor Toolkit. It multiplies the expected distance travelled on RIS2 roads, estimates the amount of fuel that would be required for these miles, and then calculates emissions from fuel use. It also takes into account the increased uptake of low-emission and electric vehicles. However, it is limited in that:

- It only includes estimates for 5 'new' schemes announced in 2021, out of the total 50 listed schemes contained in RIS2 and funded in the CSR.
- It only calculates carbon for a 5-year period rather than the full appraisal period of 60 years.
- The 5 years concerned are 2028 to 2032 during which not all of the five 'new' schemes would have been fully in operation.
- The carbon emissions do not include carbon from construction, only additional traffic.
- The carbon estimates are for non-traded carbon only.

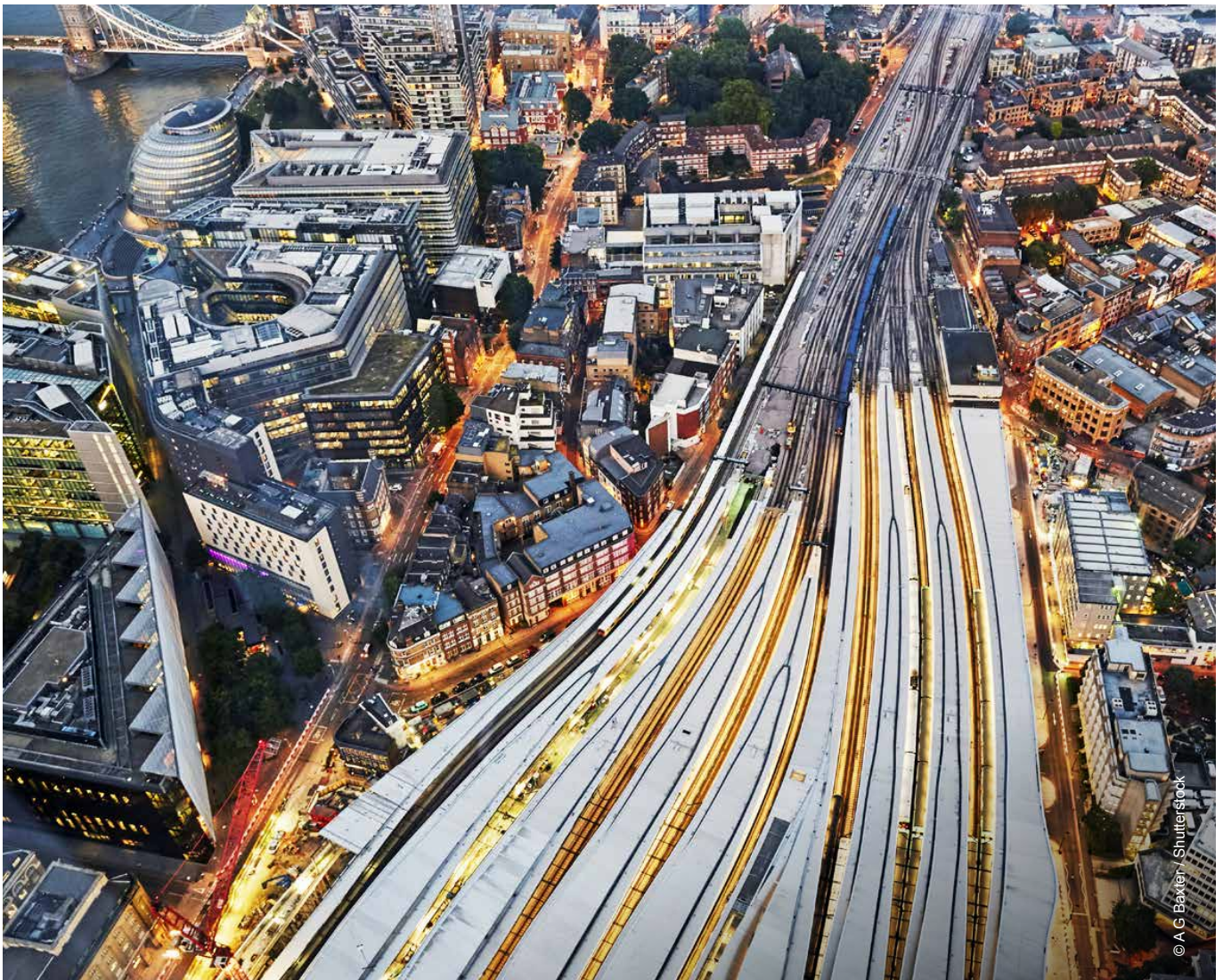
These limitations are laid out in Professor Phil Goodwin's expert witness statement presented in the court hearing (paragraphs 13-21): https://transportactionnetwork.org.uk/wp-content/uploads/2021/03/Witness-statement-of-Phil-Goodwin-23-10-2020-16-03-2021_Redacted.pdf

TRANSPORT ACTION NETWORK ESTIMATES

The Transport Action Network estimates **a total of 36 MTCO₂e (32 from road user emissions, 4 from construction) for all 50 RIS2 schemes.**³³ The total emissions still stand higher than the DfT 0.27 estimate even if we narrow the focus to the 5 ‘new’ projects, and pro-rate their emissions to the 2028-2032 time period as above. Doing this gives an estimate of 2.6 MtCO₂e (0.6 from road user emissions, 2 from construction) for the five ‘new’ projects.

Transport Action Network have built these numbers up from the individual project assessments (‘Appraisal Summary Tables’) created by Highways England. This is not a new analytical approach, as it uses the government’s own assessment figures. This approach has used the several key differences to the DfT methodology:

- They analyse the effect of all 50 proposed schemes, rather than the 5 ‘new’ ones presented in the DfT analysis.
- They have expanded the time period to 2060 rather than 2032. This is consistent with the time period assessed in each project’s Appraisal Summary Table and reflects the expected infrastructure lifetime of the roads themselves. For our estimates, we have constrained the estimates to 2045.
- They have included construction effects, while the DfT estimates only focused on user emissions.



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